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The Poultry Keeper's Vade Mecum

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THE POULTRY-KEEPER'S VADE-MECUM

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THE POULTRY-KEEPER'S VADE-MECUM

BY

EDWARD BROWN, F.L.S.

President of the International Association of Poultry Instructors and Investigators

LONDON

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THE POULTRY-KEEPER'S VADE-MECUM

Section I

INTRODUCTORY

UNIVERSALITY OF POULTRY BREEDING

No branch of stock-breeding is, or can be, so general as poultry-keeping, which is within the opportunity of almost every section of the community, each carrying out the work in accordance with its immediate conditions. That is certainly the case with fowls, and to a lesser extent with ducks. Geese and turkeys can alone be profitably bred where space is abundant.

Important points to be considered are that whilst fowls are small in size of body they are active by nature, and that they require regular attention and control. In this respect they differ from larger stock. Cattle and sheep may be left more to themselves during the growing and feeding stages. Poultry cannot be so treated. Therefore the prime factor is the human element. That explains, to some extent, the relatively small number of fowls kept on larger farms, though much more might be done by increase of the flocks in charge of each individual. It is to these greater holdings we must look for breeding geese and turkeys.

On medium-sized farms and small holdings conditions are favourable for poultry by reason of the facility with which these can be controlled and at the same time be linked with rotations in cultivation.

Owners of parks and open spaces, by adoption of Distributive or Colony methods, or by allowing poultry to run where these would not interfere with other operations or be near gardens, could contribute materially to the total production.

On allotments and garden plots, if a regular rotation is maintained, from twenty to one hundred fowls per acre can be constantly kept. In some districts railway sides and other unused spaces might be profitably utilised in this way, whether temporarily or permanently. Facilities for such operations would afford opportunities often denied to artisans and labourers.

Within the more thickly populated areas, whether suburban or urban, occupiers of gardens and even backyards can keep a few fowls to utilise household scraps and supply their families with eggs. By effective management and keeping the right breed of fowl, 800 to 1000 eggs can be obtained yearly from half a dozen hens.

In the great majority of cases, egg-production is the most profitable line, with sale of such surplus chickens as are available. Where demand is good for any class of table poultry, that branch may be specialised. If fattening establishments are within reach, excellent and good paying prices can be obtained for lean, young birds about twelve weeks old, if of a suitable type and hatched in time to meet the market requirements.

There is a further branch of the industry which has attained great importance and is, in many cases, highly profitable, namely, Breeding Poultry Farms, on which the chief object is to rear stock birds or laying pullets for sale. In many of these a large trade is also done by disposal of eggs for hatching or of day-old chicks. On the last named the hatching capacity is large, to which further reference is made

under " Hatcheries." Such is specialist work, and has become a large business.

DEMAND FOR EGGS AND POULTRY

Prior to 1914 the consumption of eggs and poultry had grown rapidly, only limited by supplies. Not only had there been a great increase of production within the United Kingdom, but vastly greater importation of both products from abroad. In 1913 the average consumption of eggs was estimated to be 113 per head of the population, of which 60 were native produce and 53 imported. The countries which have suffered most in the war period—notably, Russia, Austria-Hungary, and Roumania—were those from which the great volume of supplies were received. Italy and neutral countries like Denmark and Holland were also compelled by scarcity of feed to reduce their stocks of poultry. Hence the imports of eggs in 1920 were only equal to 20 per unit of population.

The result has been an enormous accession of values, as daily brought to every householder. Egg prices have gone up, according to the Board of Trade returns, by 241 per cent. With poultry, whilst the increase has not been so great, to the majority of people the cost is far in excess of ability or willingness to purchase. Eggs at 3s. to 6s. per dozen, and fowls at 2s. 2d. to 4s. per lb., mean that consumption is limited. Therefore it is desirable that everyone should become a poultry-keeper who can possibly do so, especially as we must mainly depend in the future on home supplies. Millions more poultry could be kept than are now found.

EGG VALUES

Housewives never had any doubt as to the food values of eggs, and medical men bore the same testimony. Chemical analysis might suggest that other foods were superior in nutritive

elements. In the laboratory, however, two important qualities could not be measured, namely, palatability and digestibility, factors of great importance, especially under modern conditions. An egg, as in the case of milk, is not to be judged by constituent elements. Investigations conducted over a period of twelve years by Dr. McCollom, of the Johns Hopkins University, Baltimore, U.S.A., have shown that growth in young animals is practically stagnant when the diet is restricted to grains and meals which form our staple feeds, whether given separately or mixed together. As a fact, animals which during these experiments were more or less starved increased in weight just as quickly as those fed upon common grains and meals. When milk or eggs were added to the feed, whether from the first or later in the period of investigation, growth was normal and the animals throve well. The facts are that in the butter fat of milk, in the fat of egg yolk, in the fat surrounding certain glandular organs of animal bodies, and in the soft leaves of vegetables, are elements which are essential factors in human and animal nutrition. This is one of the most important discoveries of recent years, equally for consumer and producer. Not only so, but eggs are a preventive food against certain diseases due to malnutrition. More and more will eggs enter into human dietary. They form an indispensable food, making for full development in the young and for maintenance of health in adults.

DISPOSAL OF PRODUCE

Eggs command good prices, varying by distances to be transported before reaching consumers. Almost without exception where prices are approximately low, the cause is due to the loss of quality by delays in and lack of proper organisation for marketing.

The egg which commands the best price is that weighing from 2 oz. to 2¼ oz. (1½ lb. to 1 lb. 11 oz. per dozen). Smaller eggs, except for a short period in the autumn during the weeks of great scarcity, are sold for cooking and realise much less than the proportionate reduction in weight would indicate if these were sold by the pound. Very large eggs are not desired in the best trade. The eggshells should be even and strong. Complaints are general as to weak-shelled eggs. On many markets a strong preference exists for brown or tinted-shelled eggs for boiling. A first quality new-laid egg is full—that is, the air space is very small, increasing rapidly with age. When tested by light, the first quality egg appears evenly opaque, without any spots or dark areas.

Small and older eggs are sold for cooking, and it is to the interest of producers to separate these from the new-laids, as it is to breed for larger size.

From September to January the greatest proportion of imported eggs have hitherto been what are known as "pickles"—that is, preserved by one method or another. The shortage in that respect is now very great, as large quantities were formerly imported. For such eggs there is a large demand at good prices. Whether disposed of by producer or trader, these should be sold as "preserved," as they are only suitable for cooking.

For chickens and fowls is a regular and steady demand, more especially in the great centres of population where a good standard of living is maintained. In addition, large numbers are used at holiday resorts, which trade, though seasonal, is a considerable and available asset to immediate producing districts. Few of these, however, produce wholly adequate quantities, and hitherto the trade has been provided for by supplies brought from elsewhere. That is a trade capable of great development.

Prices vary considerably. In London and other large cities where is a well-to-do residential or transitory population and holiday centres, fine quality chickens are largely sold, commanding high prices. Hotels and restaurants within such areas, and also at holiday resorts, use large quantities of medium quality birds, hitherto met to a considerable degree by imported supplies. Elsewhere the trade is usually in cheaper birds. Over the entire country, however, early hatched spring chickens, killed at twelve to fifteen weeks, when in sufficient quantity, command good prices. Study of the market requirements is of essential importance.

During the months of November, December, and January large fleshy fowls, which have been carefully fed off, can be readily sold, realising high prices. These are usually six to eight months old. This trade is capable of considerable increase.

Wherever is a Hebrew population old hens are in great demand at the time of Jewish festivals. These must always be sold alive, as they are killed after inspection.

Ducks form a luxury by reason of the cost. During the summer these birds realise good prices for hotels and at holiday centres. From February to June ducklings sell at high rates in the more wealthy districts. Where rapidly grown on specialist lines and killed before they are nine weeks old, production is profitable.

At one period geese were consumed to a much greater extent than is now the case. Changes in taste on the part of consumers, together with reduction of opportunity to producers, have affected prices obtainable and also supplies. In respect to the former, advances have recently taken place. Geese require free range where they can find abundance of natural food. As

they are heavy eaters, the cost of feeding must be kept as low as is commensurate with health and vigour. On the better grades of rough grazings geese can be profitably fed and raised for sale in the summer to arable farmers for feeding off on stubbles, and later to fatteners. From June onwards is a fair demand at good prices for what are known as green goslings—that is, birds three to four months old. The chief trade is for larger specimens from Michaelmas to January, and especially throughout the industrial areas at Christmas.

Demand for turkeys is always in excess of the supply. Consumption is greatest at Christmas, when prices are at their maximum. As these birds require abundance of range over untainted soil, their production is most suited to larger farm areas. Where properly controlled and on suitable soils there is no more profitable branch than that of turkey breeding.

PROFITS ON FARM POULTRY

Owners of estates or farmers have not given attention to poultry to the extent which opportunity affords. An Irish landowner (and it will be recognised that in Britain consuming markets are nearer at hand than is the case in Ireland), Sir John Keene, of Cappoquin, has published comparative figures as to his operations, which are most informative and suggestive, indicating the profits made from various classes of stock. The results are as follows :—

	Capital Value.		Total Profit.		Percentage of Valuation.	Profit.
	1917–18	1918–19	1917–18	1918–19	1917–18	1918–19
	£	£	£	£		
Store Cattle	2498	2859	379·8	546	15·3	19·1
Dairy . .	797	952	178·0	315	22·3	33·1
Sheep . .	273	240	152·6	155	55·9	64·6
Pigs . .	142	239	213·2	164	150·1	68·6
Poultry . .	27	30	108·8	154	403·0	513·0

As supplementary to general farming poultry is among the most profitable of farm stock, involving small capital outlay.

THE SUPPLEMENTARY ASPECT

As distinct from many branches of food production, the keeping of poultry can be undertaken on a greater or lesser scale by nearly all sections of the community, supplemental to ordinary sources of income and of food supply. The vast bulk of eggs and poultry produced for human consumption at home and abroad are derived from farms, where the fowls or other poultry are part of the live stock, making a contribution to the totality of returns, in some instances responsible for a high percentage. As a rule, however, the proportion of poultry to the acreage is small. What is commonly called Poultry Farming is much more intensive, requiring great experience for attainment of success, involving hard and continuous labour to obtain the maximum results. It should not be undertaken on a commercial scale by anyone without adequate capital and ability to handle profitably a large number of birds, old and young. Given these, the rewards are great. One fact must be remembered, namely, that the profit on each individual fowl is small. Therefore, to yield an adequate livelihood for those who undertake the work as a business the number maintained must be large. If a profit of 10s. per hen per annum is attained, 600 layers will require to be kept to yield a net return of £300 yearly.

Operations on a smaller scale, either as contributory to the income or to supply the owner's household with eggs and chickens, are within the reach of a much greater section of our people. Country and suburban residents, as already indicated, can do much in the direction indicated, in accordance with the amount of

land they have at command. Where the space is smaller, so must the number be decreased. The back-yarder in urban areas often finds that a flock of half a dozen hens is the limit of his capacity.

PROFITABLE POULTRY

The stage has long passed where the profitableness or otherwise of poultry is open to discussion. That such is the case has been abundantly proved in every section of the country. It is entirely a question of costs in relation to returns. Expensive equipment, labour in excess of what is required, high-priced appliances and feed, can never be economic, any more than are elaborate greenhouses and pleasure gardens. Under such conditions the satisfaction and pleasure derived have to be placed against the money expended, as well as the fact that the household is supplied with high quality of produce and in the finest condition. Not only so, but from all houses there are table and kitchen food scraps which can be fed to fowls, preventing waste and reducing the costs of production, plus whatever there may be in the way of healthful and interesting recreation for men and women alike, and a consciousness of doing something to increase home supplies and make the nation increasingly independent of imports from abroad.

Among the many examples which could be given as to success achieved, where the object is to make a profit from the fowls, what has been done in the manufacturing districts of East Lancashire and the West Riding of Yorkshire may be cited. The breeding of poultry has always been popular there, formerly for exhibition, within recent years on utility lines. As a form of recreation to the cotton and wool operatives, giving them that open-air exercise essential for health and for supply of their

household requirements, its benefits have been great. Uncertainties of employment, combined with an ever-increasing demand for eggs, have led to great extensions, affording an alternative and supplementary source of income in the first place and meeting local requirements in the second. The results are remarkable upon these poultry allotments varying from a quarter of an acre upwards, for which high rents are paid. The fowls have helped to raise the standards of life in the entire districts named. Not a few of the men have gradually extended their operations and built up large and profitable businesses, whether as breeding farms or plants for egg production.

COMMERCIAL EGG FARMS

An ever-increasing and rapidly advancing demand for eggs, together with higher prices within recent years for better qualities, have led, both in this country and America, to concentration of large numbers of hens, kept entirely for laying, upon a comparatively small area of land. At one period for purely market production these did not realise a satisfactory measure of success. In many instances the addition of breeding for sale of stock, eggs for hatching, and day-old chicks, as referred to in later paragraphs, had to be adopted to avoid failure. Large numbers of others did not succeed by reason of heavy expenses for equipment and management and that whatever natural food was in the land rapidly became exhausted, and thus the feed costs were very high in comparison with farm poultry. Up to a point the returns did not advance correspondingly. That is no longer the case. Selective breeding, namely, development primarily of the laying quality, by eliminating the less productive birds, by provision of a more suitable environment, by a clearer understanding of management and feed-

ing, by greatly advanced prices for eggs, and a score of other influences, have changed the entire aspect of affairs. Production upon these commercial poultry farms has advanced to a considerable degree. The same is true upon general farms and among household flocks, so that the average egg production is much greater than was the case at the beginning of the present century, even though at the time named marked progress had been made. Anticipations, however, have not been wholly realised. Unsuspected influences have arisen or been recognised. Yet it can now be claimed that commercial egg farms have an assured place in production, and where favourably placed can, under proper management, be conducted profitably.

THE SPHERE OF EGG FARMS

Already the statement has been made that the extent of operations in order to yield a profitable return must be adequate as a question of business, owing to the fact that each unit is a comparatively small producer. On the basis of a net profit of 10s. per hen per annum can be computed how many fowls must be kept to give the desired income. An important factor is that, following a general rule, as numbers increase there is a tendency to reduction of average productivity and to increase of costs. By this is meant that it is difficult to maintain the same average of eggs with 100 hens in one flock as with a score, and with 200 as with 100; also that the average costs for food and equipment rise owing to lesser care in management and control. The reason for this is not apparent, but the fact is as stated. That is especially the case when labour has to be employed.

On what are termed "one-man plants," that is, where the entire work is done by one man or woman, the maintenance of 600 laying hens

can be carried out, plus all the accessory operations, and yet not make too great demands upon the time of the operator. To maintain such number it will be necessary to either hatch or buy about 500 chickens annually, if the birds are retained for three years, and one-third replaced every year; if they are only kept for two years, as has been customary, then 750 day-old chickens or 300 pullets must be so bred or purchased. The former numbers stated are due to the fact that half will probably be cockerels, and there must be a margin, so that only the best and most virile may be selected. To rear such numbers will involve considerable labour during the growing periods. On larger plants labour will have to be employed, and the absence of personal control often leads to disaster. Poultry-keeping is essentially an individual enterprise.

An indispensable factor is that, in order to ensure the eggs shall command the highest returns, which can only be when they are of the finest quality, and the least cost for transit to market, these must be within easy and speedy reach of great consuming centres. Hence it is clear that Commercial Poultry Farming finds its greatest developments near to thickly populated areas.

UTILITARIAN ASPECTS

Whilst all poultry-keepers should aim to maintain purity of race in the fowls, and that in appearance these shall be attractive over the greater part of the year, the greater majority are primarily concerned with productivity in respect to eggs or flesh, for in this way profit or loss is determined. To these it is of no moment however beautiful a fowl is in the colour or perfect the feather covering may be, if these do not yield eggs or flesh in sufficient quantity or volume to leave an adequate margin

of profit above the expenses of feeding, etc. Thus we have explanation of efforts to increase the average fecundity of hens or attainment of rapid maturity in table chickens and other poultry. Upon farms and among household flocks 35 to 40 eggs per annum should pay the food costs; upon egg farms the number is 50 to 60. In addition to feed the other expenses will add 50 per cent, so that on farms and among household flocks the amount of profit depends entirely upon the number of eggs produced in excess of 45 to 60 per hen. That determines the payment for services rendered. On commercial egg farms it requires 75 to 90 eggs to pay feed and basal expenses, and the degree of profit is determined by such eggs as are laid beyond the numbers stated. As a consequence, yielding the greatest returns are indispensable if a sufficient profit is to be gained. For a hen to leave a margin of 10s. per annum to her owner she must lay 30 to 40 eggs beyond those required to pay the costs of her feed and maintenance. That is ever the problem, and explains why so many poultry farms have failed. It also indicates why upon general farms a handsome profit can be realised when poultry farms have failed. Upon the last-named reduction of expenses to the lowest degree compatible with efficiency and attainment of a higher average number of eggs produced must be the aim. It shows why so many have been compelled to add other branches, such as sale of stock, etc., to their operations. At the same time we see why merely external characteristics are regarded as of minor importance by those who are engaged in utility poultry keeping.

In the neighbourhood of fattening establishments, as met with in Sussex, West Kent, and elsewhere, farmers and other rural residents have made considerable profits by hatching and rearing chickens. The same is true near to

watering-places and holiday resorts, inland and around our coasts. Attempts have been made in this country, on the continent of Europe, and in America to rear on a large scale very intensively, but without success. More or less natural conditions are essential during the growing periods.

POULTRY EXHIBITIONS

A powerful influence has been exerted by poultry shows in creating an opportunity for the competitive factor, making for improvement and advance. How far injury, directly or indirectly, has been wrought by the adoption and exaltation of abnormal characters at the expense of productive qualities, or to what extent and how elaboration in colour of plumage has led to loss of constitutional vigour by close breeding and feeding to obtain the maximum of condition, do not enter into present consideration. It may be accepted that at the outset adoption of fixed standards, if rightly drafted, for any breed is a great gain, that such standards guide a multitude of breeders as to the lines upon which they can base their efforts, and that competition gives a zest which could be secured in no other manner. It is in the application of standards too rigidly, and the adoption of methods in breeding which ignore productive qualities where injury is wrought.

To a large extent, breeding for exhibition is a gamble in which the risks are considerable, for no one can tell what competitors will present themselves, if the views of judges will be the same as those of the breeders, or whether exhibits will maintain their condition and display themselves in the best manner, when to do so will be effective. Nor is the interest immediate. The skilful breeder prepares months, often years, in advance of the time of testing. How to select the best birds as breeders, to mate them rightly,

what will be the results of mating, how the chickens will develop and the degree of quality they will display, as well as the period of preparation and training, offer a combination of uncertainties, plus latent factors within the birds themselves, that are fascinating in the extreme, culminating when the judge's decision is announced. Even failure to achieve the success aimed for has its compensations in that great pleasure enters into the pursuit. Many freely spend money in this way, feeling that they are well repaid. Where is achievement of the object in view great gains frequently follow. As an advertisement for stock nothing can equal a win at one of the classic exhibitions, leading to a profitable demand for birds. Stock of this kind sell at high prices. A single specimen will realise from £20 to £50 in many breeds, even to £100 and more in others. Money, however, is only a small factor. To buy a bird capable of winning prizes is comparatively easy. To know how to mate such bird is another question. And the greatest glory of all is to breed a specimen that will win for its owner a coveted prize or prizes. The exhibition field is a very wide one, but to assume that those who take it up are necessarily making an important contribution to food production is misleading. It is frankly a sport in which the utilitarian aspect frequently does not enter, though not necessarily so.

LIMITATIONS

Is it worth while ? is a question that must be answered by each individual. If so, what method should be adopted, and how to proceed will depend upon conditions, opportunities, and desires. The present work is designed to afford some guidance to those desirous of taking up this branch of food production. An essential factor is that whatever limitations there are shall at the outset be recognised. In all cases

one of the chief dangers is in attempting too much. Many failures have arisen because of insufficient capital or experience, mainly the last named. Lack of money may be overcome ; want of knowledge seldom can. It is not numbers, but ability to manage the poultry that determines successful accomplishment. Unless, apart from labour, profit is made with a few birds it will not be gained by adding to the size of flocks. The townsman, with his back-yard or garden plot, must be content with half a dozen hens. Properly cared for, they can be made to pay, whereas a dozen on the same space would be too many. And so throughout the entire range, up to the farmer. The egg farmer, with three or five acres of land, ought to be able to secure an excellent return with 300 or 500 hens ; whilst an increase of 50 per cent will generally mean halving his profit, probably entire failure.

WHERE SUCCESS LIES

As in every line of life there are some who fail where others succeed, so in poultry husbandry. Many failures in this branch could have been foretold from the outset, by reason of the fact that the basis was unsound and that the methods adopted were on wrong lines. Generally speaking, these have been more or less intensive, not as supplemental to farming or as a side issue on the part of cottagers, smaller occupiers, and householders. This is a totally different proposition to that which is now advocated. Something can be done in the way indicated, but not to the extent frequently assumed. Upon that aspect of the industry more will be said, and, as far as possible, it will be indicated what are the opportunities, what are the limitations and the dangers of more intensive methods, and how far these can be applied with safety. What has ever to be kept

in view is that a failure may discourage others from embarking in any pursuit. Those who succeed say little about it. So far as is known, no farmer who is skilful enough to make his other work profitable, and who has conducted his poultry operations with due regard and relationship to other branches and with equal attention, has found poultry unprofitable. In fact, many have frankly stated that the poultry section was one of the most profitable branches of their operations.

INADEQUACY OF POULTRY STOCKS

Such returns as are available show that on farms—by which is meant holdings of an acre and upwards—in Great Britain the adult poultry are not more than two-thirds of a fowl per acre of cultivated land, and that in Ireland upon holdings of a quarter of an acre and upwards the average is equal to one and one-seventh fowl per acre of cultivated land. These figures at once reveal the reason why home production is inadequate to the needs of the country. Our poultry population is altogether too small, and might be greatly increased without interference with other stock or any form of cropping. We have no desire to displace, rather to make increase in other branches. When estimating the national stock we must not omit to take into consideration the multitudinous smaller poultry-keepers who are excluded from the agricultural returns. Even, however, when these are added, there is less than an adult fowl per acre in Britain, and in Ireland than 1½ fowl per acre.

WHAT MIGHT BE

In view of what is stated above it will be desirable to consider what could be done. Within some areas the opportunities in the aggregate are greater than in others, by reason

of the general conditions and the class of farming generally adopted. For instance, in large farm districts we cannot expect the same *pro rata* development as where the occupations are less extensive, not because of lack in natural opportunity, or of adverse environment, but that the distribution and degree of human population are unfavourable for giving that oversight which is absolutely necessary for poultry. Allowing for such variations, it may be accepted as a moderate computation that the country as a whole could maintain an average of three adult fowls per acre of cultivated land, without changing present methods to any serious extent, and simply as an added crop. To do that, however, would need a profound modification of method, in that the birds would have to be more equally distributed over the land. Such numbers would be absolutely fatal if concentrated around the homestead, as is too often the case on farms at present. One point, however, must be made clear, namely, that in calculating the poultry population one goose or turkey has to be regarded as equal to five fowls or ducks, in that the former would require five times as much space to roam over. If the average named were attained, not alone would our requirements be met by home production, but provision made for a largely increased consumption which will assuredly take place in the future if native supplies are forthcoming. In these directions production on special poultry farms and by what are termed Household Flocks would add considerably to the total output.

FACTORS FOR SUCCESS

There are many poultry-keepers who, like the amateur gardener, regard profit as a minor consideration, in that their chief objects are the pleasure of breeding and the growing of poultry for supply of their households with eggs and

chickens of the highest quality. So far as eggs are concerned it is, with few exceptions, impossible to purchase these of the same quality and freshness as where produced on the spot, even when allowance is made for the idealism of consuming what is the result of our own efforts. With such amateurs the attainment of success is dependent upon a variety of factors. And, apart from what may be termed abnormal expenditure, such an elaboration of houses and runs, of more costly equipment for fowls and of labour, which are non-essential, there should be no reason why the enterprise cannot be made to pay. The owner of a large greenhouse or well-laid-out gardens does not expect, however, to make these an economic success.

The factors upon which the result depends are as follows :

Breed or class of poultry kept, which must be suited to the conditions and possess capacity in accordance with what is desired. In that respect there are great differences, as indicated in Section II.

Environment. Unless the conditions fit the breed, and the breed their conditions, we cannot expect success. In this respect, as shown in Section III, are involved questions of space and general equipment.

Management. Here arises the entire question of control, upon which so much depends. Productive capacity is modified profoundly by a host of influences ranging through generations prior to as well as during the life of each individual fowl. Therefore special attention is given to these in Section IV. And

Feeding, as contributory to health of the birds, to their productivity, and to avoidance of waste, in which direction so many owners of poultry fail. In Section V this subject is fully dealt with so far as general principles are concerned.

Section II

BREEDS AND BREEDING OF POULTRY

BREEDS AND VARIETIES

The breeds and varieties of poultry are bewildering by their number. These terms mean as follows :

Breed : A race with characteristics and qualities which in combination make it distinctive and which it is able to perpetuate and reproduce in its progeny.

Variety : A member of family of any breed, which, whilst maintaining the racial characteristics, varies in one or more of these, generally colour of plumage.

Thus the generic name " Leghorn " indicates a race of fowl which originated in Italy, and is now most widely distributed over the entire globe. Of this there are at least eight different colours. When we speak of " White Leghorns," that indicates the variety. In some races there is only one colour, so that for these the term variety is not employed. In all others the subdivisions are indicated by a prefix to the breed name.

One of the author's previous works (published 1906) gave descriptions of 186 breeds and varieties of fowls, 13 of ducks, 12 of geese, and 8 of turkeys, kept in one country or another under domestication, whether for food production, for sport, or for pleasure. Such list, however, was not exhaustive, as the purely ornamental breeds and varieties were not included, of which there are many. Among these latter may be named Bantams, of which some have a distinct value in food production, as stated below.

ENVIRONMENTAL CONDITIONS

Naturalists agree that the great majority of breeds and varieties of fowls are descended from the Jungle fowl of India, in which country the parent stock is still found in its wild state ; that domesticated ducks are derived from the Mallard or Wild Duck ; that domesticated geese have arisen from the Grey Lag or other wild species ; and that the breeds of turkeys owe their origin to the Mexican and American wild turkeys generally distributed over large portions of the North American continent. Of these, the wild duck and goose are migratory, widely disseminated, thus explaining their appearance in almost all countries. Fowls and turkeys are not, as a rule or to the same degree, migratory, and, as a consequence, their distribution has been artificial—that is, by arbitrary transference from one country to another, due to man's action.

The evolution of the different breeds and varieties of domesticated poultry is a study of profound interest. It cannot, however, be dealt with adequately in the present work. It is enough to state that the first taming of a fowl appears to have been in India for the sport of cock-fighting, long prior to the beginning of the Christian era. Not until the time of the Roman Empire, nearly two thousand years ago, was it specifically bred and reared for food supply, at first as a luxury, later more generally. Ducks and geese were tamed so as to increase food supplies, and the turkey also. The last named were thus found to be bred in vast numbers when the Spaniards invaded Mexico after the discovery of America.

Variation is a law of nature, even under the original conditions. When transference takes place such tendency is greatly increased. Hence followed in the first place a natural evolution

of distinctive types and colours, which in process of time became breeds, in accordance with soil and other conditions, and as a measure of protection. Thus a basis was laid for many changes, though the evolution was slow. After breeding became controlled and selection adopted, the introduction of new breeds and varieties was comparatively rapid. A large percentage of modern breeds are the result of artificial selection. Even with these climate and soil and feed have had a powerful influence in modifying the structure, colour of legs and skin, and productivity of poultry.

CHOICE OF BREEDS

During recent years the number of breeds and varieties finding general acceptance has shrunk very considerably, more especially in the British Empire and the United States of America, as compared with what was formerly the case. On the continent of Europe that was evident, except in one or two countries, to a much more limited extent. In several of these, more especially France, Belgium, the Netherlands, Italy, and Spain, many districts have had their own breeds of fowls, which appeared to conform to the immediate conditions. The explanation is largely due to a great development of commercial poultry farms, on which production is chiefly for eggs. Essential factors are not only, under these conditions, that there shall be responsiveness to breeding for a higher average fecundity, without which semi-intensive methods cannot be made profitable, but that activity of body and constitutional vigour shall enable the birds to bear the strain of heavy laying. As a consequence, experience has practically restricted choice to a few races and varieties, of which the most popular are the White Leghorn and the White Wyandotte. Where poultry are supplemental to other

branches, as upon farms, it is usually found that the heavier class of fowls, such as the Orpington, Plymouth Rock, and Rhode Island Red, are preferred, in that these have larger bodies and carry more muscle, so that when chickens or hens are sold for killing better prices are realised. In those districts which specialise in table poultry the Sussex and Orpington, among British breeds, are most popular, in that their flesh is abundant and of fine quality.

Outside the purely economic considerations, and where predilection or preference or pleasure are supreme, the range of choice is greatly extended. That applies also to such as breed for exhibition. Those who make a business of sale of stock birds, eggs for hatching, and day-old chickens have to keep in view the breeds of poultry for which demand is greatest. In that respect changes take place, as there are ups and downs in breeds, and popularity is a fickle jade. The more productive breeds, however, maintain their position to a greater degree than such as are mainly ornamental.

SUITABILITY OF BREED TO CONDITIONS

Whatever may be the object in view, it must ever be kept in mind that there are influences of which we have inadequate knowledge. Suitability of breed to environment is, therefore, essential to success. In this respect nature of soil and elevation are of supreme importance. As a rule, climatic variations in the British Isles do not seriously influence operations. It is, however, apparent that in colder and more exposed districts egg production should be the chief object; in warmer areas, where land is good, table poultry can be produced much more rapidly and of a higher quality.

Elevation is important in choice of breed to be kept. With all classes of stock it is found that the size of body of any animal decreases

with the elevation of the land, as that vigour of constitution and activity of habit must be greater upon higher ground than where the land lies low and is warmer. As a result, the smaller and more active races are more productive on elevated positions than are others.

Soil is equally important. Upon heavy clay lands chickens are slow in growth, making a greater amount of bone, and the muscle upon their bodies is harder than where the earth is lighter and warmer. Therefore, egg-production should be the chief aim. Such is equally the case where the elevation is high. To produce quickly and profitably good table chickens, the soil must be dry and porous, the position favourable in respect to sunshine, and the altitude moderate or low. Wet land is, however, unsuited, though meadows occasionally flooded are usually rich in natural feed.

As a general rule, active and lighter bodied poultry thrive better on heavy soils, more especially those with yellow skin, flesh, and legs.

CLASSIFICATION OF POULTRY

The races of poultry of all species have been classified in accordance with the qualities for which they are characterised or which are most prominent in them. Selection, however, cannot be mechanical. A breed or variety which proves most successful in one place may fail in another, due to a different soil or elevation or other and unknown factors. Further, in one area there appears to be a tendency to flesh development, in another to egg production. As examples, the Sussex fowl is now the premier table fowl in Southern England, as is the Breese fowl in the Ain department of France. Transference of both further north, and where conditions are more rigorous, minimises the meat properties and stimulates egg laying. In each case these breeds have proved most productive. Further,

some breeds named below are close to the border-line dividing the respective classes. The following embrace the leading breeds met with in the United Kingdom. The arrangement is alphabetical and does not represent any order of merit :—

Egg Breeds (in all cases non-sitters) :

Ancona.	Leghorn.
Braekel.	Minorca.
Campine.	Redcap.
Hamburg.	Scotch Grey.
Houdan.	

Meat Breeds :

Breese.	Cornish Game.
Crevecœur.	La Fleche.
Dorking.	Sussex.
Game.	

General, or Dual Purpose Breeds :

Faverolle.	Plymouth Rock.
Langshan.	Rhode Island Red.
Malines.	Wyandotte.
Orpington.	

Ornamental, or Exhibition Breeds :

Andalusian.	Courtes Pattes.
Aseel.	Crested Dutch.
Bantams.	Polish.
Brahma.	Black Spanish.
Cochin.	Black Sumatra.

EGG BREEDS OF FOWLS

These are generally characterised by small or medium-sized, compact bodies, by relatively large posterior development, by activity of habit, and by full-blooded combs. As already stated, they are non-sitters—that is, the proportion in which development of the maternal instinct by becoming broody is small, owing to suspension of that function.

ANCONA FOWL

Of Italian origin, deriving its name by reason of the fact that fowls of this type are largely met with in districts around the port of Ancona, on the Adriatic Sea, whence the first specimens were imported. It would appear to be related to the Leghorn, or Tuscany fowl, which in many respects it resembles in type.

The body plumage is mottled black and white in both cocks and hens, due to each feather of green-black being tipped with creamy white, which gives it the mottling, except in the male bird, whose neck hackle is black with white stripes, and the tail white with a black tip. The comb is single, erect in the male, and falling over in the hen. When first imported, the ear-lobes were red or creamy white, which is still the case when bred ordinarily, but for exhibition a pure white ear-lobe is insisted upon. The legs are mottled black and yellow, thus making the Ancona and the Leghorn distinctive. The appearance of a well-bred flock is very pleasing, and in some sections of America the breed has won considerable popularity.

The Ancona is one of our best layers, and the eggs are good in size. It is hardy and active, the chicks very precocious and rapid in growth. Of a nervous disposition, it is less amenable to restriction than others, especially in small runs, and is easily frightened by the advent of strangers. As an exhibition fowl the Ancona has never attained more than a modest prominence.

BRAEKEL FOWL

A Belgian breed which, prior to the European War, was extensively kept in Western Flanders. In all essential characteristics it is the same as the Campine, described below, except in size of body, due to the fact that the last named were

bred on the poor lands of the Campine, whereas the Braekel had the advantages of rich and well-cultivated soil, thus making for increased size. When the two races became popular in Britain and America they were amalgamated, so that our Belgian friends regard what we call Campines as Braekels, owing to the greater size. As producer of eggs and of milk-chickens it has no rival in Belgium.

CAMPINE FOWL

Tradition has it that the ancestry of this breed can be traced back to the thirteenth century and that it descended from a Turkish fowl. For centuries it has been bred on the

SILVER CAMPINE HEN

sandy Campine, in the provinces of Antwerp and Limburg. A precocious bird, excellent as a forager and finding a large part of its nutrition, upon lighter lands it was most profitable to the peasants of the area named.

In body it is small in size, with a full, round breast, neither wide nor deep. It carries a large

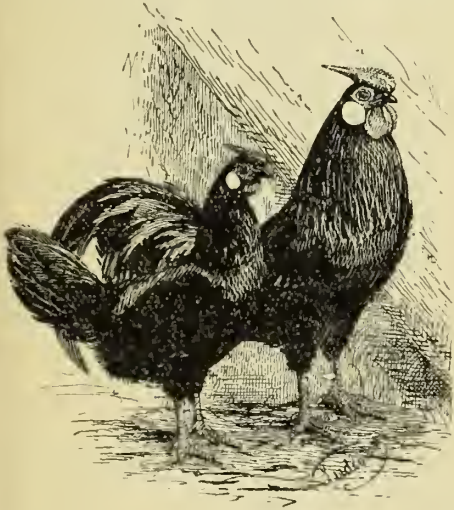
single comb, erect in the male and falling over on one side in the hen. The ear-lobes are bluish white, the legs dark slate-blue, and the skin greyish white. There are two varieties, namely, Gold and Silver. In the former the neck hackle and ground colour on the body is of a rich gold. On the body each feather has narrow bars of greenish black. In the latter the neck hackle and ground colour on the body are white, the body feathers finely barred with greenish black. The tail feathers in males of both varieties are black, but in the hens are barred. The appearance is very pleasing indeed, in which respect Silvers are generally preferred, except where the Golds are very rich, which is not usually the case.

As layers Campines are remarkable, often exceeding 200 eggs per annum, the size well up to the market requirements. As milk-chickens —that is, when about eight weeks old—the cockerels are regarded as a great delicacy. Up to the present Campines have not proved acceptable to owners of large flocks. For the smaller poultry-keeper, more especially amateurs with large gardens or small paddocks, the combination of beauty with productive qualities is most attractive. Under the conditions named they prove hardy and vigorous.

HAMBURG FOWL

Of all the races of domestic fowls no one excels the Hamburg in its beauty of plumage, sprightliness of carriage, perfect conformation of the body, breed characteristics, and prolificacy as a layer. Descended from the Friesland fowl, which has been bred for centuries in the northern provinces of Holland, for three-quarters of a century the Hamburg has been developed by the remarkable skill of Yorkshire and Lancashire breeders. As an exhibition fowl it has no superior and few equals. In that

direction, however, what has prevented attainment of a fuller measure of popularity is due to adoption of a rigid standard for shape of comb, and that for prize winning trimming of that character has been regarded as a necessity. To this practice few breeders will lend themselves. On the other hand, in spite of the fact that



BLACK HAMBURGS

Hamburg hens are probably the best layers we have, their eggs are too small to satisfy market requirements. For the amateur possessing a reasonable amount of ground it combines beauty and utility to a high degree.

Brilliancy of plumage is characteristic of this breed and is found in all varieties. The body is small and compact, ranging in mature hens from $3\frac{1}{2}$ to $4\frac{1}{2}$ lb., and with a prominent round breast. The neck is medium in length and

carried gracefully, surmounted by a short and smart head, on which is a rose-comb, flat on top, square and broad in front, gradually tapering behind, and ending with a long spike. The ear-lobe is round and pure white. The legs are fine and black in colour. The tail is long, and cocks carry large sickle feathers. There are five varieties—namely, Black, in which the entire plumage is a brilliant soft green-black; Gold and Silver Spangled, each feather in hens and in the males on breast, thighs, tail coverts and thighs tipped with a round green-black spot or spangle; Gold and Silver Pencilled, in which the feathers are transversely crossed with parallel lines of dense ticks. In the Golds the ground colour is a rich golden bay, and in the Silvers is a silvery white.

By reason of the small body, Hamburgs do not carry much flesh. That, however, is excellent in quality. Their chief economic value is as layers. For household purposes the small size of these is not the disadvantage that would otherwise be the case, so long as they are abundant in number.

HOUDAN FOWL

As the name implies, this breed, of which there is only one variety, is of French origin. At one period they were almost universal in the Seine-et-Oise Department, west of Paris, a district supplying large quantities of eggs and table chickens to the French capital. Their place has more recently been occupied by the Faverolle.

The features of this breed are highly distinctive. Large medium in size, a bold, full, round appearance is given. The plumage has a ground of glossy green-black, on which are white splashes evenly distributed, thus producing a mottling which gives a homely aspect. The neck is fairly long and abundantly covered with feathers. Upon the head is a full crest, the

feathers of which fall backward ; and under the face are whiskers or beard. In a damp climate a crest or " top-knot " is always a handicap in that the birds are liable to suffer from colds. The comb, fairly large, is not found on any other fowl, and it is like the open shell of a mussel, with small serrations at the edges, in the centre of which is a fleshy protuberance. The legs and feet are stout and short, and there are five toes instead of the usual four, whilst in colour the legs are pinkish white, slightly mottled with black. The flesh and skin are a creamy white.

Houdans are excellent layers of large eggs, and equally good in flesh properties both as to quantity and quality. In neither direction, however, does it compare with what may be termed special breeds. On the balance it occupies a high position. For crossing it has been very popular. Had it not been for the crest, unduly increased by exhibition breeders, it might have occupied the front rank.

LEGHORN FOWL

This, the premier breed in all parts of the world as an egg producer, originated in Central Italy. It is common in Tuscany and generally throughout other sections of that country. Among continental nations it is called " Italien." The designation given by Anglo-Saxons was due to the first specimens shipped to the United States from the port of Leghorn. Its activity of habit, precocity and vigour of constitution, adaptability to almost all conditions, excellence as a forager, and responsiveness to breeding and control for egg-production have, in combination, given it the highest position in many countries. That is especially the case with the White Leghorn, of which there are more than any other breed or variety of fowl. Wherever commercial egg farming is conducted—in the United Kingdom, Denmark, the United States

of America, Australia, and South Africa—the Leghorn is supreme. Whether on range or where restricted it is equally valuable for the purpose stated.

The Leghorn fowl is built as a layer. The body is small medium in size and wedge-shaped, wide at the shoulders and full behind, allowing expansiveness for the egg organs. The back is round and sloping and the general carriage upright in front, with large, closely carried wings.

WHITE LEGHORN HEN

The head is small, with a strong beak, carrying a large single comb, which falls on one side in the hen. The wattles are in keeping, and the ear-lobe rather large, white or creamy light in colour. The tail is moderately full and carried high in the males. The legs are fairly long. Both these and the feet are yellow, thus in keeping with the colour of the skin. It has a sprightly and graceful appearance. There are eight varieties, leaving out those bred as rose-combed, chiefly for exhibition—namely, Whites, Blacks (both self-coloured in the plumage),

Browns, Buffs, Piles, Duckwings, Blue, and Cuckoos. Of these, the Whites and Blacks are chiefly bred for utility, though in that respect Browns, resembling Black-red Game—that is, the same as the original jungle fowl—are excellent. The others, kept to a small degree, are mainly for exhibition.

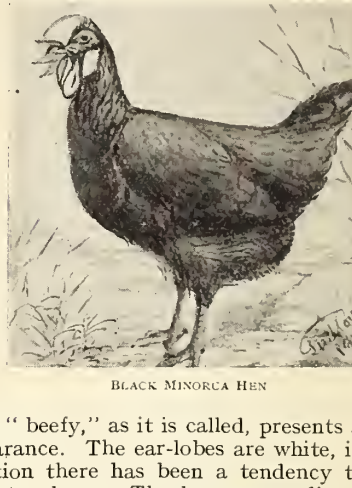
As indicated above, the Leghorn is an egg producer first and foremost. Carrying a small amount of flesh, which is hard and moderate in quality, except when very young, it has little value for meat. Like all heavy egg producers it is nervous in temperament. Fortunately, in the major varieties, the utilitarian qualities have been well preserved.

MINORCA FOWL

Although the name given to this breed would indicate that it came from the island of Minorca in the Mediterranean, personal observations in Spain would indicate that it is an improved type of the Castillian fowl found in several parts of the Peninsular. The first importations were received in the early part of the nineteenth century and were brought to Devonshire, where, until the 'seventies and 'eighties, it was mainly kept. Since those decades it has gained wider recognition. Bred by exhibitors for a massive round, deep body and for excessive development of comb and wattles, together with the fact that it requires a warm, kindly soil and is somewhat slow in feathering, a sign of weakness, it has not maintained the position formerly held or the promise of general adoption. It has been more an exhibition than a utility fowl, in which respect a reaction is taking place.

The Minorca has a round, full, and deep body, with broad shoulders and long back, sloping well to the tail, which is full, with broad sickles carried well up. The neck is long and thickly covered with hackle. Apart from colour of

plumage, the greatest amount of attention has been given by breeders for exhibition to the head points, which by excessive development and also increase of weight have done harm to the breed. Instead of combs and wattles of a size in conformity with that of the body, these have been exaggerated into monstrosities, taxing the system and causing discomfort to the birds. As the Minorca comb is single and upright in the male, if heavy it falls over, and



BLACK MINORCA HEN

when " beefy," as it is called, presents a coarse appearance. The ear-lobes are white, in which direction there has been a tendency to breed these too large. The legs are medium in size and strong. There are two varieties, Blacks and Whites respectively, but the latter are scarcely ever met with. These have white legs and feet, the colour on Blacks being very dark slate.

Minorca hens are naturally among the most prolific layers we possess, and the eggs are large in size, usually weighing $2\frac{1}{4}$ to $2\frac{3}{4}$ oz. With larger size of body and combs the tendency has

been to reduce the tale of eggs, which, combined with the tendencies to weakness of constitution, has checked its popularity. There is a movement towards moderation in all directions. If universally adopted, this would do much to restore the breed to its former position.

REDCAP FOWL

What appears to be a relation of the Gold-Spangled Hamburg fowl is the Redcap, taking its name from a large and somewhat coarse rose-comb. At one period it was widely kept in the hilly districts of South Yorkshire and Derbyshire. To a limited extent it is still found in the latter county. The general acceptation is that the Redcap is due to a mixture of Game blood with the Golden-Spangled Hamburg, as it is larger in body and the colouration of feather is not nearly so brilliant. In other respects there are distinct resemblances. Hardier by nature, the Redcap appears to be specially suited to hill countries where it can have free range. As a layer it stands high, and the eggs are good in size and fine in flavour. The flesh qualities are also good.

SCOTCH GREY FOWL

Formerly this breed was widely distributed over many sections of southern Scotland. That, however, is no longer the case, as it has been displaced by breeds which are more prolific as layers. Its origin is in doubt. The weight of evidence appears to indicate that a grey-plumaged fowl was general in that country, which has been improved into the present form.

The ground colour of the Scotch Grey is a pale bluish grey, each feather evenly barred with metallic blue. The beak is white, often streaked with black, and the legs and feet mottled black and white. It has a long neck and head, a medium single comb, a broad, full

breast, and a broad, short back. The bone is stout and heavy, and the size of body large, averaging 8 to 10 lb. when fully grown.

Although usually a non-sitter, the Scotch Grey is, in respect to qualities, an all round fowl. It is a fair layer of large-sized eggs and carries an abundant quantity of fine flesh which, together with the skin, is white. It is, therefore, most useful where is a demand for plump chickens and fowls. In these days, however, specialisation appears to be the primary commendation.

MEAT BREEDS OF FOWLS

Within the last generation an ever-increasing demand for eggs and advance in prices have tended, except in a few districts, towards lessened demand for those breeds which are characterised by fine quality and abundant flesh. Such has not been the case in some countries of Europe, where poultry meat enters more into the dietary of the people than in Britain. In that direction a reaction may be anticipated, and Meat Breeds of fowls will regain much of their lost popularity. A further point is that the races included in this class have not the activity of habit or the vigour found in the Laying and General Purpose Breeds. In some of these a quiet, indolent disposition is manifest. They require favourable conditions, more especially a dry, warm soil. Some are good sitters, others not so. Size when killed is an important consideration. As a rule, the Meat Breeds are less suited to restriction or inclusion within runs than are the prominent egg or general purpose breeds.

BRESSE FOWL

For quality of meat and abundance of flesh in relation to the size of body no race of fowl excels the Bresse, which for generations has

held a prominent position on the Paris and other French markets, where fine quality is appreciated. It is a native of the Ain district of France, to the south of Burgundy, lying between Macon, Lyons, and the Jura Mountains, near to the Swiss border, a highly fertile, well-cultivated region. In general appearance the Bresse fowl resembles the Leghorn or Italian type, differing, however, in colour and flesh, skin and legs, and in its qualities, as well as in length of frame.

The body is long and deep with a prominent chest, showing capacity for meat. The neck is short, the head long and fine, with a single comb of moderate size, upright in the male and falling over in the hen. This of fine texture, in itself an indication of good quality meat. The bone throughout the body is fine, as are the short legs, which with the feet have a dark blue skin. The cock's tail is moderately developed. When in lean condition these birds are small-medium in size and do not appear to give a promise of the great flesh development which characterises the breed. There are four varieties—namely, Grey, which is most popular in France, White, Black, and Blue. In Britain the Whites have gained the greatest amount of favour.

The remarkable quality of the Bresse fowl is in its capacity for flesh development when fatted. Birds weighing 6 lb. in ordinary condition can be made by that process to gain from 3 to 4 lb. in five or six weeks, when the edible meat will be more than 60 per cent of the total weight, owing to the smallness of bone and offal. French Bresse are good layers. In Britain the experience has been that it is superior in that respect as a result of the stimulative influence of colder conditions. As a family fowl, where sufficient land is available, both for supply of eggs and chickens to the household, this breed has no superior.

CREVECŒUR FOWL

Although kept to a very limited extent in this country, where the moist conditions have, by reason of its large crest, conduced to increase of an inherent tenderness of constitution, shown by its being very subject to colds, this breed is kept to a considerable extent for its meat properties in one section of Normandy. The opinion generally held is that it is the result of a cross with the Polish fowl referred to among the Ornamental Breeds.

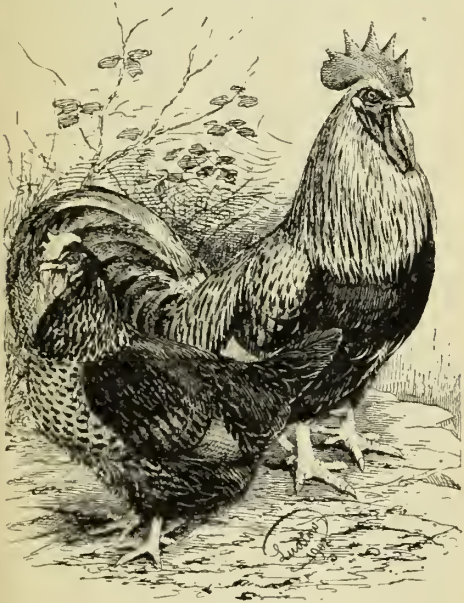
The body of the Crevecœur is large and square, broad in front and back, long, and with short legs and tail, giving a somewhat dumpy appearance. The head is long and strong, surmounted by a globular crest, with full muffs or beard below. The comb is horned, with spikes well apart. In size it is medium, 6 to 8 lb. There are three varieties—namely, Blacks, which are most common, Whites, and Blues. In the first named the feathers have a bright black sheen, legs and feet slaty blue. In the Whites the limbs are pinky white, but of these there are few met with.

The hens are fair layers. It is, however, essentially a Meat Breed, the quality of the flesh being very high. The birds fatten well.

DORKING FOWL

During the last thirty to forty years the Dorking fowl has steadily lost in popularity; now it is kept to a very limited extent. In respect to fineness and quality of flesh it has no superior. Where the soil is dry and well drained, upon larger estates there is much to commend it. As a farmer's or ordinary poultry-keeper's fowl others are to be preferred. The origin is unknown. Probably it was brought from Italy during the period when Britain was subject to the Roman Empire, for an Italian

breed at that period, so far as records are available, was similar in practically all points including the fifth toe. Also fowls of this type are met with in France. The reasons for this loss of popularity are the delicate constitution of the Dorking and that, in breeding for large



DARK DORKINGS

size of body, with excessive development of keel or breast blade, vigour has been further sacrificed. As in the case of the Bresse and the Sussex, the object should be to have a smaller frame on which flesh can be added during the final stage by fattening. Very large size is unnatural in the fowl and involves slowness of growth.

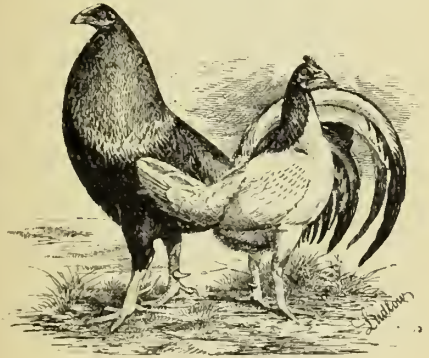
Massiveness is an essential feature of the Dorking, which is long, deep, and broad, forming a rectangle a little longer than deep. The keel, or breast blade, is very deep, and as the bone is soft and fine there is danger of this becoming bent, especially if growth is forced. Comparatively the short neck, heads, and legs appear small. It has abundant plumage and large wings. In all varieties except Whites the comb is single. The legs are short, stout, though not heavy in bone, and with the feet are fleshy white, and on each foot is a supernumerary toe, making five instead of the usual four. The persistency of this feature is remarkable. There are five varieties—namely, Dark or Coloured, Red, Silver-Grey, White, and Cuckoo. Of these, the Darks are heaviest, the Reds probably the hardiest, and the Silver-Grey most pleasing in appearance. In quality of flesh Silver-Greys and Reds are finest.

Although not very prolific as layers Dorkings are early in coming into profit, which is of great importance for securing spring chickens. Its great quality is in flesh development, more especially upon the breast, as the amount of thigh muscle is relatively small. For length and thickness of breast meat it is remarkable, the quality and texture of which are very fine indeed. It is, as may be expected by the size of the body, somewhat slow in growth for spring chickens. The skin, which with flesh is of a delicate white, does not fill out as in the case of other breeds. The hens are excellent sitters and mothers. As already indicated, for the Dorking dry soil is essential, and it requires kindly conditions.

GAME FOWLS

Cock-fighters are responsible for the meat properties of the Game fowls, in that strong, large wings were essential to success. Thus, as

the meat found upon the breast or keel of birds form the motor muscles for the wings, by so doing these were enlarged. Further, as constitutional vigour was an essential, and any softness or weakness fatal to winning in the cock-pit, by breeding the basis was laid of a strong, virile, active fowl, which qualities have characterised it long after cock-fighting was tabooed as a sport. Although a good fighting cock could not be a bad colour, yet at the same



BLACK RED GAME FOWLS

time many of the varieties were brilliant in plumage. Prohibition of the sport named was correlative with a rise of poultry exhibitions, to which breeders turned their skill and thought with equal success. Thirty to forty years ago the Game fowl classes at our leading poultry shows were remarkable both for the number of exhibits and quality of the birds, indicating that breeding was both a science and an art. With these gradually came a great change in the type. A Game cock for fighting must have a good reach, that is, length of head, neck, and legs. Exhibitors, however, exaggerated these cha-

racters until there was excess to an extent that balance was lost between them and the size of body. As a consequence there are two distinct types of Game fowls—the old fighting standard and the reachy modern Game. It is freely admitted that the former are the more beautiful.

In all there are more than ten varieties of Game fowls, of which the Black-breasted Reds and the Brown-Reds have commanded the greatest amount of popularity.

Breast development is the great economic feature of all these varieties. There is not much muscle on the thighs. The flesh is close in texture and fine in flavour, but by its firmness birds should be well hung after killing to soften the muscle, when thick and long slices of rich meat are obtained. Some of the older type of Game hens are excellent layers, where these can be given plenty of land to roam over. As a fact, Game are not suited to any other conditions. The eggs are rich and deeply tinted in shell. The pugnacity of these birds in itself is an explanation why so few are kept, in spite of excellent economic qualities. Cock-fighting may be good sport, but does not make for profit among ordinary flocks.

CORNISH GAME

The general designation of this breed is Indian Game, which is misleading. Indian birds undoubtedly formed the basis with the English fighting Game and the Malay ; but the breed as a distinctive type was evolved in Cornwall, where, as in West Devon, it is bred extensively, more especially for its meat qualities or for exhibition, though to a lesser extent than was at one time the case. The lacing upon hens and markings of the male birds offer great opportunity to the breeder's skill. In America it has

many admirers, and variations from the one colour known in Britain have been evolved.

Cornish Game are big, massive, heavy-boned fowls, with thick, strong legs and feet and a broad body. The legs are wide apart and the carriage upright. The head is large and strong, with a closely set pea-comb, giving a somewhat fierce aspect, especially when trimmed, as is customary for exhibition. Cocks often reach 11 lb. in weight. The plumage is close and tight, and in cocks is of a rich green-black with black or chestnut markings, and in the hens chestnut-brown with green or glossy-black lacing. The legs and feet are deep yellow, as is the skin.

As layers Cornish Game hens are poor, the eggs being very deep in tint of shell and rich in quality. The breast meat is short but remarkably thick, the skin being well filled. It is, however, hard and close in texture, and the dead birds must be hung several days for softening to take place, when it is excellent in flavour. As is the case with all heavy-boned fowls, growth is slow. The chief value of the Cornish Game is for crossing with soft-fleshed races to produce table chickens.

LA FLECHE FOWL

The home of this breed is the La Sarthe district of France, to the north of the River Loire, where it is bred as a winter fowl of very fine quality, carrying an abundance of beautiful white flesh, and is in great demand upon the Paris and other markets, commanding high prices. In these respects it is only second to the Bresse fowl. It is constitutionally delicate, somewhat difficult to rear, for which reason in our more rigorous, moister climate it has not found any marked favour.

Large in size, La Fleche have a long, deep, and broad body, a full breast, long legs, dark

slate or blue in colour, and a full tail. The head is fine and long, surmounted by a large horned comb with two spikes and a small blunt protuberance behind. The wattles are long and the white ear-lobes large. The plumage over the entire body is a beautiful black, with metallic-green reflections, and the whole appearance sprightly and attractive.

As already indicated, this breed is noted for its flesh qualities. The hens, however, are good layers of large-sized eggs, which are fine in flavour, both due to the rich soil of the district where it is generally met with.

SUSSEX FOWL

What can now be recognised as the premier English breed for flesh qualities is the Sussex, taking its name from the county whence emanate the finest table fowls probably of the entire world. That has been the case for more than a century. So far as records are available, birds of the type named have been bred for a much longer period in South-Eastern England. With the popularity of the Dorking and rise of breeding for exhibition the Sussex became almost extinct. Fortunately, a few of the families of farmers in that county retained the old stock, and about twenty years ago, by establishment of a club, it was again brought prominently forward, since which time it has rapidly grown in favour. Considerable numbers have been exported to America. That there is a relationship between the Dorking and Sussex would appear probable, even though the latter has only four toes and the former five.

Whilst the Sussex presents the same rectangular shape as the Dorking, it is not so massive in appearance. Lighter in bone, it has less feather and is not so large in comb, all of which are secondary, as these are of no ultimate value. In comparison the Dorking might be

thought to be the better. Such is not the case, however, as there are advantages in a smaller size if to that when fattened more flesh can be added. The legs, feet, and toe-nails are white, and the flesh and skin are also white, the former specially delicate in texture. There are three varieties—namely, Reds or Browns, Lights, and Speckles. For some unexplained reason, probably because of greater constitutional vigour,

LIGHT SUSSEX COCK

the Light Sussex has attained the greatest amount of favour, with the Speckled second.

Where the Sussex has proved its value is adaptability to different conditions. Although for the production of fine flesh and to attain early chickens a kindly, warm soil is essential, as that influences rapidity or otherwise of growth, it does exceedingly well on heavier lands which are well drained, notably if arable. There, however, it improves as an egg producer and loses somewhat in flesh. At the same time it is primarily a Meat Breed, and responds to the fattening process.

GENERAL PURPOSE BREEDS OF FOWLS

Exceptional development either as layers or for meat production, together with suspension of the maternal instinct as in non-sitting breeds of fowls, is a result of domestication, more especially of selective breeding. To a considerable degree such tendencies are enhanced by conditions of climate, soil, and nature of food. Where egg-production is highly stimulated there is a corresponding reduction in the quantity and quality of flesh. As meat is increased upon the body the number of eggs laid is smaller. What we term the General Purpose Breeds are those in which the natural balance is maintained. Whilst the Egg Breeds give a greater supply of eggs than do these, they are much inferior in quantity of flesh, both on chickens and older birds. On the other hand, the General Purpose races do not, as a rule, compare favourably with the Meat Breeds named above, yet are better layers and are much more vigorous, which is a great recommendation under normal conditions. Without exception they are good sitters and mothers. When engaged in these duties there is a rest from ovarian activities. That appears to make for an increase of egg-production in winter. In almost all countries this all-round type of fowl is preferred by farmers and others who keep fowls on a supplementary basis.

FAVEROLLE FOWL

This type of fowl was evolved in the Houdan district of France for the purpose of meeting demand for large, quick-growing chickens and also for hens good as layers. So well was this accomplished that the Faverolle has practically displaced Houdans throughout the area where formerly the last-named breed was supreme. It is a composite fowl, as the appearance indi-

cates, in which the Crevecœur, the Dorking, and the Light Brahma have been engrafted upon the Houdan. The result is that, useful as the Faverolle is, it lacks uniformity and the breeding is very uncertain, producing colours somewhat indiscriminately. It is essentially a business fowl.

Large, broad, and deep in body, with a wide breast set upon what appear to be shortish legs, it looks what it is, a meaty bird, which aspect is enhanced by an abundance of feather. The head is stout, surmounted by a single comb, and below are full beard and muffs, which, as there is no crest above, give a thick aspect to the upper part of the neck. The legs and feet have on the outer side a row of soft feathers, and it carries, as does the Dorking and Houdan, a fifth toe. The size is large medium. The flesh, skin, and legs are white. Colours vary greatly in the plumage, but salmon, light, and black are the more general.

For ordinary purposes this breed has proved most valuable, from the fact that it is hardy and active, an excellent forager, the chickens make rapid growth, and the hens are good layers of tinted-shell eggs. As an exhibition bird it has not met with much favour, owing probably to dullness and homeliness in colour of plumage.

LANGSHAN FOWL

Were it possible to trace the history of this breed, probably we should find it to be one of the oldest pure races we possess. That is indicated by its remarkable prepotency if crossed with other pure breeds, when the Langshan manifests its dominancy. Around it has gathered, ever since its importation from China in 1872, fierce controversies, first, as to whether it was distinct from the Cochin, and second, at later periods, as to type, owing to exhibition breeders having adopted an exaggerated form,

namely, breeding for excessive length of leg and neck, differing greatly from the original birds. As a consequence of the last named there are two distinct forms, what is called the Croad Langshan, closely approximating to those first imported, and the modern Langshan, bred for length, as stated. Of these, the former is the more useful and, in the eyes of most people, the more beautiful.

The Langshan is an upright, tall fowl, larger-medium in size. The body is fairly long and wide, set on legs of medium length, well apart, the head and tail, with legs, forming an almost equal Y. The head is small, surmounted by a moderate-sized single comb, and having small wattles. The eyes are large and bright. Legs and outer toes of the feet are dark grey with white toe-nails. The body plumage is black and very brilliant in sheen, in which respects few breeds are its equal. The Croad Langshan is well balanced, whereas the modern or exhibition type in that respect loses by its inordinate length of neck and leg. The original colour was black. From it two sub-varieties have been evolved—namely, White and Blue respectively. These are, however, few and entirely bred for exhibition.

As a layer the Langshan is characterised by production of very richly tinted brown-shelled eggs, which are fair in size and greatly appreciated for boiling. Good layers in winter, the hens are disposed to be broody at other seasons. The skin is very fine and the flesh light grey, almost white, and good in quality; but, as might be expected, the thigh muscles are well developed. Langshans require kindly conditions, where they thrive excellently, although the chickens do not grow very rapidly.

MALINES FOWL

Although this is regarded as the great table fowl of Belgium, that is, for production of the

famous *poulets de Bruxelles*, yet its qualities require that it shall be placed in the General Purpose section. Prior to the war it was extensively bred in the provinces of Antwerp and East Flanders. It is a composite race, evolved from the Langshan, Flemish Cuckoo, and Antwerp Brahma. Very large in body, Malines follow closely the Asiatic type, more especially the Brahma. The body is long, deep, and massive, with a prominent breast and straight keel, a short, well-covered neck, strong head, and single comb. The wings are short, and the body feathers fairly abundant. The legs are long and the bone stout, but not heavy in substance, which is regarded as important. On the outer side and along the feet are feathers, following the Brahma, but not so heavy. The legs and feet are pinky white, and the flesh and skin creamy. There are three varieties—namely, Cuckoo, which are most common, White, and what are known as Turkey-headed.

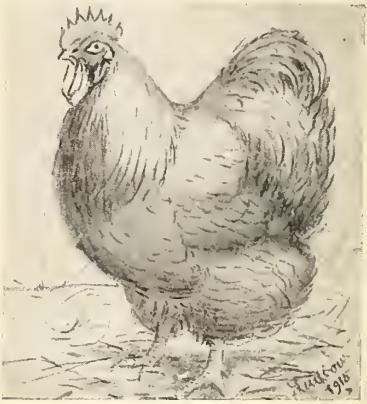
By reason of the size the Malines is not a rapid grower, so that its main purpose is as a table fowl rather than a chicken. At six months old it weighs, when fatted, to which system, from the quiet disposition, it responds very successfully, 7 to 8 lb. The flesh is excellent in quantity and quality and is very soft. A good sitter and mother, it is only a fair layer, though good in winter.

ORPINGTON FOWL

Six varieties bear the name of Orpington, each of which had a totally different origin to the others. Of these, the Buff and the White have taken high positions equally for exhibition and utility; whilst the Black, Cuckoo, Jubilee, and Spangled are only kept for the former purpose, and are bred to a very limited extent. First were the Blacks, which at one time had a considerable vogue, more especially among

suburbanites and town residents. That is no longer true. The history of this breed is very interesting. It is enough for the present purpose to deal with the Buffs, which are very popular in several counties, and the Whites. The following notes refer to these two varieties.

The size is large and the body broad and deep, the breast prominent and shoulders broad, whilst the back is short. The wings are of good



BUFF ORPINGTON COCK

size and carried closely up. It has a neat head and strong beak, with a medium-sized single comb. The legs are short and stout, without any feathers, and pure white, as are the feet and skin. The appearance is compact and well balanced. In Buffs the plumage varies from lemon to a buff, generally deeper in cocks than hens, which are apt to become patchy. The beak is horn colour. In Whites the plumage is pure, and the beak also white.

Both in Buff and White Orpingtons the combination of white flesh and skin on the body

with the laying of tinted-shelled eggs explains much of their popularity for utility purposes, although without natural vigour of constitution, which both possess, that could not have been maintained. They fatten exceedingly well. The Buffs especially fill up the skin, giving a plump appearance which captivates the eye. The last named are lighter in bone than the Whites, which, however, cannot be called heavy boned, as that is of a porous nature. For winter egg-production Buff and White Orpingtons are good. They are reliable sitters and mothers. Whilst showing a large measure of adaptability dry soil is most suited to them, as is usually the case with white-fleshed fowls.

PLYMOUTH ROCK FOWL

As indicated by the name, this breed is of American origin, in which country it is widely distributed. As a farmer's fowl more of it are to be found in that country than of any other breed. Several races were included in its composition, but for forty years it has been fixed as a distinctive type. The barred variety, which is most general, has responded remarkably to efforts for improvement of its characteristics without deterioration of productive qualities, due to the fact that the colouration of plumage and markings have not led to methods which worked against either its egg or flesh properties. Moreover, exaggerations of special features have been avoided. Introduced into Britain in 1879, it speedily attained a recognised position. Although the advent of the Orpington weakened this, it is still one of our most useful fowls, more especially under farm conditions, where its hardy, active nature is specially valuable.

Built upon large, deep, and square-bodied lines, the Plymouth Rock presents a compact appearance, especially as it is equally balanced. It evidences strength and vigour, all parts of

the structure being stout without grossness. The neck and legs are medium in length, the head is in good proportion, with a neat single comb, small wattles, and full, bright eyes. The wings are small and carried well up. The legs, feet, and skin are yellow, but not very deep in colour. The male birds often run up to 11 lb. when fully matured. The barred variety was the original form. In both males and females

BARRED PLYMOUTH ROCK COCK

the feathers have a whitish blue ground colour, with transverse and narrow bars of beetle-green black. Sports from these are the Black and White respectively, each of which is self-coloured. Buffs had a different origin, and in respect to the colour of plumage follow the Buff Cochin—namely, an even buff varying from lemon to orange.

Reference has already been made to the vigour of this breed, which is one of its leading assets. Another is adaptability to almost any conditions of soil, climate, and elevation,

whether at liberty or in restriction. The chickens grow fairly fast, and at about fifteen weeks old, if fed properly, make large, well-fleshed birds, although the colour of flesh and skin excludes them from the finest trade. That can be overcome to a considerable extent by fatting, except in the leg colour. For winter fowls they are excellent. The hens are good layers in winter. At other periods a fault is persistent broodiness. As sitters and mothers they have no superior.

RHODE ISLAND RED FOWL

In the section of the State of Rhode Island where this breed originated there was no intention of forming a new type, but by crossing to

RHODE ISLAND RED COCK

secure a fowl that would give in eggs and chickens what the market demanded. Like Topsy, "it growed," in the doing of which a new and valuable race was evolved which has spread widely in America and attained a fair amount of favour in Britain. Not that its

essential qualities are in advance of those found in breeds already with us, but that it is vigorous in the extreme and lays deep brown-coloured eggs of a large size. So far as exhibition is concerned, doubtless the uncertainty in colour of plumage is in itself an attraction to breeders, involving skill to bring about greater fixity.

In shape, Rhode Island Reds follow the American type as expressed in the Plymouth Rock and Wyandotte, except that the breast is somewhat flatter and the head is broader and that the tail is less elevated. It is heavy and hard in bone, and consequently somewhat slow in growth. Medium in size, the appearance is more that of a Wyandotte than a Rock. The neck and legs are of medium length, the thighs being covered with soft feathers. Shanks and skin, as in all American races, are a rich yellow, with a line of red down the outer side of legs. There are two divisions, as variety is not a correct term—namely, single-combed and rose-combed—all other characters being identical. The ideal plumage is a rich, even red, deeper and more brilliant in cocks than hens, which latter are often very patchy—that is, showing lighter patches. The colour is difficult to secure and to maintain.

A fairly good layer, carrying a considerable amount of meat on the body, the Rhode Island Red is a useful all-round fowl. Were it not for the deep yellow of flesh and skin it would find more favour. It is an excellent sitter and mother, and the chicks mature with reasonable rapidity.

WYANDOTTE FOWL

The only rival to the White Leghorn as a great egg producer is the White Wyandotte. In the various Laying Trials it often attains the first place. It has an advantage in that there is more and better meat on the body than has the

Leghorn, against which is the fact of the eggs being, as a rule, smaller, often falling below the 2-oz. standard. It originated about forty years ago, the first being Silvers, in which were concerned several races, notably the Sebright Bantam, Cochin, Hamburg, and Brahma, from which amalgam it is surprising so good a result has been obtained. From that the White evolved as a sport, also the Black, whilst the other varieties resulted from various crosses.

WHITE WYANDOTTE HEN

In shape the Wyandotte is short, cobby, and compact, with moderately tight feather, and has not the elevation of head and tail indicative of Asiatic origin as seen in other General Purpose Breeds. The back is broad and short, and the breast well rounded. It is, however, full behind, as is usual with good laying races, owing to expansion of the egg organs. The neck is medium in length, as are the legs, and is well covered with hackle. The head is short and broad, surmounted by a rose-comb not seen on any other breed, in that it is thin and broad,

lying close and following the line of skull. In size it is small medium—that is, in males, 6½ to 8 lb. In all are nine varieties—namely, Silver, Gold, White, Black, Buff, Partridge, Silver Pencilled, Buff-laced, and Columbian.

Active in habit, hardy, good as foragers and adaptable to nearly every environment, the Wyandotte has proved a most valuable breed. As already indicated, owing to excellent laying quality, in the first place, and to elimination of colour factors, the White variety occupies the foremost position. The legs and flesh are creamy rather than yellow, and when fatted much of the tinge is lost.

ORNAMENTAL BREEDS OF FOWLS

The races of fowls which are specially bred either for exhibition or the pleasure of breeding the exceptional, are numerous. Not a few of these have considerable productive qualities, insufficient, however, to give them a place in competition with the breeds already named. Either by high development of feather characters or by abnormal points the proportion of birds reared which attain a high exhibition standard is small, and in some instances there is a delicacy of constitution which militates against general adoption. All are attractive by reason of the fact that they afford an opportunity for exercise of skill in breeding, in itself always full of uncertainties, which fact explains the wide popularity of the exhibition system. In some breeds, at any rate, the business is very profitable, as prices for first-class specimens—say, £10, £20, £50, and even £100—are often paid. This is a field of breeding requiring special study, and cannot be adequately dealt with in a work like the present. The following notes summarise features of a few ornamental breeds.

ANDALUSIAN FOWL

Of the Spanish type and related to the Minorca and the Black Spanish. It is a good layer of large-sized eggs. Constitutionally, however, it is found to be somewhat delicate, slow in feathering; the chickens, unless conditions are very favourable, are not easily reared, requiring a warm, kindly soil with sheltered position, where it succeeds very well.

The colour of plumage is what we know as blue, that is, the ground colour is a silvery blue, and each feather on breast and thighs of the male and body of the hen is edged, or laced, with black. This is not a basal colour for fowls, and is one of the most difficult to maintain. As a fact, it does not reproduce itself, and the blue plumage arises from mating of black and almost white specimens. Consequently breeding involves selection on exceptional lines. It is a non-sitter, with good flesh qualities when young.

AZEEL FOWL

As the name indicates, this breed is of Asiatic origin, giving every appearance of a fighting type, for which purpose it has been bred in the Far East, where that sport has been for centuries and is very popular. It is pugnacious to an extreme, even chickens showing at an early age the fighting spirit. For that reason it can only be kept by those who are able to separate the flocks and to whom the type appeals. As a practical fowl it is of no value for the reason stated, although carrying a considerable amount of flesh. As layers the hens are mediocre.

Small medium in size, the body is broad, the shoulders high and prominent, narrow in posterior, and mounted on thick, strong, short legs. The head is short and strong, surmounted by a pea or triple comb, with bold eyes. There are several varieties, and no fixed standard of colour

is adopted. Azeel hens are excellent sitters and mothers.

BLACK SPANISH FOWL

The classic example of breeding for excessive development of an abnormal and unnatural feature is the Black Spanish, descended, like the Minorca, from Castillian fowls which are common in the Peninsular. Its peculiar feature is believed to have been first developed in the Netherlands during the period when those countries were ruled by the Kings of Spain. It is a non-sitter and prolific layer of large-sized eggs, for which reason it was extensively kept by amateurs fifty to sixty years ago—that is, before the advent of Leghorns, Wyandottes, etc. It is poor in flesh, very delicate indeed, difficult to rear, and slow in feathering. A non-sitter.

The type is similar to the Mediterranean races—that is, medium in size of body, well developed in the posterior, mounted on rather long legs, and carrying a single comb. Its plumage is entirely black. White Spanish have occasionally been met with. What makes this breed distinctive from all other races of fowls is that the white ear-lobe has not only been extended all over the face, but hangs lower even than the wattles, forming a kid-like addition, which, however, for exhibition involves plucking of small feathers growing thereon. Whether the white face is ornamental must be decided by individual taste.

BLACK SUMATRA FOWL

A very beautiful fowl, originating in India, and which appears to have been first imported into the United States of America in 1847. In Asia it was bred for fighting purposes. It is very close and compact, small medium in size. The Sumatra is long and broad in body, with great muscular development on the breast, has medium length of neck and legs, and the head,

which is small, is surmounted by a pea-comb fitting closely to the skull. The tail is full and drooping, that of males touching the ground. The plumage is of a very rich glossy beetle-green or green-black, giving it a brilliant appearance, and the legs are dark olive or black. It is a good sitter and mother. The flesh is very abundant and fine in texture, but hard when freshly killed ; and the hens are moderate layers of rather small white-shelled eggs.

BRAHMA FOWL

Historically one of the most interesting of breeds, originating in Asia, but transformed after introduction into America and Europe, this breed has passed through many stages. Seventy years ago it was regarded as the fowl of the future—that is, productively, attaining wide popularity. Then it became the leading exhibition fowl, and good specimens commanded very high prices. Now it is but the shadow of its former self and is found in very few hands, more, however, in America than Great Britain. This decline was due to increase of feather on the body, to ultra-refinement of markings in the Dark variety, and to excessive development of feathers on legs and feet, which are thickly covered. The result has been to reduce the amount of edible meat on the body and the fecundity, and, as feathers are costly to produce, make for greater expense in growing, not compensated by maintenance of favour as an exhibition fowl. It has been valuable in crossing to form other breeds.

There are two varieties—namely, Darks and Lights, the former of which is the finer in appearance, and the latter more useful. Very large in body, made specially apparent by abundance of feather, it is U-shaped and well balanced, and clad, as stated, to the ground.

The head is small, with a neat pea-comb. The legs, feet, and skin are yellow. In bone it is very heavy, which means slow development in chickens. Very hardy, the hens are excellent sitters and mothers and are good winter layers, the eggs being deeply tinted in shell, yet on the smaller side.

COCHIN FOWL

Introduced from China in 1848, this breed early received royal patronage and was in large measure responsible for a great boom in breeding of poultry, which did much to establish and popularise poultry exhibitions. Its virtues, real or supposed, were heralded to an extent unknown before or since. Fortunes were made and lost by breeders, usually the former, as the buyers generally were the losers. For such furore there was no justification, as Cochins could not be regarded as of first grade either for eggs, although these are very rich, or for flesh, which, except in very young birds, is hard and not abundant. The same is now true, only more so, as a result of long and continuous breeding for heavy feather, in which respect, notably on thighs, legs, and feet, the Cochin and Brahma are alike. The shape of the two breeds, however, is totally different, as the Cochin is not so tall and much more massive in appearance. It also has a single comb. Yet there is no more perfectly balanced race of fowl, and when the colouration is even it is one of the handsomest breeds we possess. There are five varieties in all—namely, Buff, of which there are two shades, lemon and cinnamon ; Partridge, which are very rich in colour ; White, Black, and Cuckoo. It has always had many admirers. A long purse is needed, plus knowledge of breeding and of preparation for the show pen, to succeed in those competitions.

CRESTED DUTCH FOWL

Although usually classed with the Polish fowl in Anglo-Saxon countries, this beautiful fowl is distinct. The combination of black body and tail plumage with a large white, globular crest is very effective. To maintain sharpness of definition between crest and neck hackle is not easy, for which careful selection and great skill are required to accomplish such result. Unfortunately for exhibition much trimming of objectionable feathers takes place. A second variety is slate-blue in the body and tail, with a white crest. The body is deep and short and the breast prominent, the legs short and strong, dark slate-blue in colour. These fowls are essentially suitable for ornamental purposes, as they are quiet in disposition and bear confinement well. When young the flesh is abundant and fine, whilst the hens are excellent layers. They require shelter. In a moist climate the head covering makes them subject to colds and bronchial affections.

POLISH, OR PADOUE FOWL

Fowls of this type are widely known from Russia to France, from which it is probable that the Crested Dutch is descended. In France they have been bred for a long period of time. In respect to general characters the qualities which have been stated above applies also to Polish, except that the crest is not so globular. The size of to-day is small medium. There are in all five varieties—namely, Gold, Silver, White, Chamois, and Buff. Whites and Buffs are self-coloured. Golds have a ground colour of golden bay, and Silvers of silver-white, with edging or lacing of black on each feather. When even, the effect is very beautiful. Chamois have a ground colour of buff with silver-white lacing.

BANTAM FOWLS

The diminutive is always attractive and pleasing. In poultry of every kind small size is usually combined with sprightliness, with greater perfection of build, and with increased beauty of plumage. That is certainly the case with Bantams. There is no exaggeration in stating that the most beautiful races of fowls, also of ducks, are among those which are miniatures, whether distinctive or reproductions of larger breeds. No section of a poultry exhibition more represents the breeder's art than does that of Bantams, enhanced by the assurance and confidence of these little birds, who make up by self-assertion what they lack in size. Whilst what is here stated applies to ornamental characters and general conformity, it is equally true that, productively, many of the races of Bantams have great value—that is, taking into account the space required for and the food consumed by them, which, in both instances, are small in the extreme. A dozen Bantams can be maintained in health and vigour on a plot that would be cramped for a couple of the larger races, and they will eat less than one large bird. As layers, not a few of the breeds of Bantams are remarkable, and in the majority there is, relatively, a large amount of flesh of fine quality on the body. Eggs are, however, small for market purposes, and there is no sale for chickens of these races when killed. To meet household requirements size would not count to an equal degree, explaining why among town residents in Belgium the breeding of Bantams has been largely encouraged, for sake of children. There is not the same temptation to sell as would be the case if eggs and birds were marketable.

Of breeds of Bantams the list is a very long one. The first came from Asia, where the art

of breeding has been practised for centuries, and in some countries whatever is exceptional is sought for with avidity and great skill applied in breeding. Several of the older races were directly imported from that continent. Others have been evolved in Europe as a result of sustained and continuous mating and breeding. Where these are diminutives of larger races this has been effected by mating one of the Bantams with small specimens of the breed to be duplicated, selecting year by year until the desired size was obtained. In some instances this has taken several years.

Bantams are divided into two sections—namely, Game, in which both old English and modern are included, and Non-Game. In all there are more than sixty breeds and varieties. Weights vary considerably. In some the standards provide for as low as 16 to 20 oz. in the male, and 14 to 17 oz. in the female, though 12 to 14 oz. is by no means uncommon, and others range up to 48 oz. These, however, are exceptional. The breeding of Bantams is a special branch in which the pleasurable side is supreme, yet the economical factor is present to an extent which is not usually recognised, from the fact that these have been regarded as purely ornamental or for exhibition. Remarkable skill is applied to their breeding, often in directions which offer difficulties that seem to be greater than can be overcome. With that in view in-breeding is frequently resorted to, which tends to loss of vigour even if greater refinement be attained.

CROSSES BETWEEN BREEDS

All progression in animal life is based upon what are known as pure breeds and varieties of such breeds. By these terms is meant that in racial and distinctive characters, which in combination give an individuality to a family or

race, mating the two sexes reproduces in their progeny whatever is common to both, taking into consideration the marked difference in plumage of male and female fowls. How the individual characters, features, and qualities originated is practically unknown and does not concern us here. Our business is to accept what exists. Under natural conditions—that is, when fowls or animals are in a wild state—there is a working towards uniformity, with developments of variations when the environment and food are changed following upon migration. The process appears to be slow. Under domestication it is much more rapid, not alone because there is arbitrary transference of birds from one place to another, but by reason of rigid selection on special lines. In this respect man accomplishes in a decade what Nature would take a hundred or more years to effect.

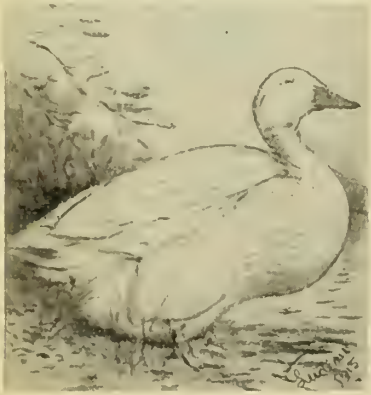
For exhibition purity of race is essential. As a basis of breeding the same is true where utilitarian objects are dominant. And with amateurs who keep fowls for their own pleasure it is undoubtedly the case that a flock of birds which present uniformity are most attractive. In the case of all pure breeds, however, more especially those who have been bred on defined lines for a fairly long period of time, there is a marked tendency towards loss of vigour. As refinement increases fertility, productivity, and strength tend to decrease. This can in large measure be counteracted or, at any rate, the effects be deferred. It is, however, present.

Hence it is that where the object is to obtain a maximum either of eggs or flesh, for both of which physical vigour is essential, crosses between two distinctive breeds are found to give greater results than would be obtained from each breed. To that end there must be what can be termed sympathetic selection. For example, if the object is to increase egg-production

the breeds so mated should both be good in that quality. Such crosses often produce a medley of colours and an indefinite variation in the progeny. That, however, can be disregarded by the practical operator if the desired result is obtained. It has to be remembered that the gain indicated is largely restricted to the immediate generation, that cross-bred birds are of less value than pure stock for breeding, in that the special quality which characterises them is unlikely to be transmitted, and that the absence of a pure type reduces their value upon the market either as layers or breeders. For production of chickens to be killed cross-breeding is commended, using pure parents ; but for all other purposes a pure race is in every way preferable.

DUCKS

Unless there is either a stream or sheet of water available those who live in urban or suburban districts should not attempt the keeping of ducks, for the reason that water is their



AYLESBURY DUCK

natural element and they thrive best when it is at hand. Dwellers in country districts have considerable opportunities in this branch. The habits of ducks and fowls are entirely distinct, and the two should not be kept together. If, as is sometimes done, ducks are provided with a small tank of water they make the place wet and dirty. Where conditions are favourable ducks are very profitable, in that they are

INDIAN RUNNER DUCK

generally very prolific, frequently exceeding the egg production of fowls, whether in greater or lesser flocks. What is stated below as to housing equally applies to ducks, save that these do not require to be so high in the roofs from the fact that ducks sleep on the ground.

There are many varieties of ducks, some of which are very beautiful. One of the oldest is known as the Rouen, which has the feather colour and markings of the Mallard or Wild Duck. It attains a large size, is a good layer,

and carries rich flesh, but is somewhat slow in growth. The Aylesbury Duck stands pre-eminent for its flesh qualities, and at the same time is an excellent layer. Owing to rapidity of growth it is mostly bred for supply of ducklings during the Spring months, when prices for these birds are very high. It has pure white plumage. The Indian Runner is only about half the size of the Aylesbury, and, therefore, although the meat is very fine it is not in favour for market purposes. It is a remarkable egg producer, and the eggs are of a moderate size, with a milder flavour than those from other breeds of ducks. The shape of body is peculiar, in that it is very high in front and broad behind, giving it a bottle-like appearance. There are several colours, of which the fawn is most popular.

BREEDING AND SELECTION

By the term breeding is meant the actual process by which a male and female are mated with the object of perpetuating the race, whether that mating be voluntary or otherwise. When in a state of nature the choice is entirely free, at least on the side of the male. What are the principles which guide the instinct under those conditions is unknown. In the great majority of cases the result is that the racial character and qualities are fully maintained. Selection is that, owing to the fact of mating being arbitrary under domestication, where an attempt is made to breed for specific purposes, the onus is upon the owner-breeder. Therefore this subject is of essential importance. Much of the fascination of poultry arises from the power of changing features and characteristics, certainly of improving many of these, of forming new combinations, and in this way to evolve fresh breeds and varieties. It is often the way of profit as well as of pleasure.

The great majority of poultry-keepers are not and do not seek to be breeders in the sense indicated. Some are what may be termed selectors, that is, they choose certain birds for the work of reproduction, and in many cases with a large measure of success. Others, and the greater number, are producers. Their object is to secure profitable output of eggs and poultry. All have their place and are indispensable to the poultry industry. The breeder, however, is one who seeks to discover the workings of Nature, to apply whatever knowledge he may possess in order to improve the stock in accordance with his ideals, whether these be external characteristics or productive qualities. He endeavours to mate his birds in conformity with some definite scheme or plan, to which end a careful study is made of each individual bird and, as far as possible, the history of its family. In so doing there are many disappointments; conclusions arrived at do not work out as hoped for, but when success is achieved satisfaction in accomplishment is ample reward, and often accompanied by great monetary gain. Breeders are the architects of the poultry industry, as practicians are the builders. In the following paragraphs are set forth some of the knowledge which has been gained over many years.

INHERITANCE

There would appear to be no limit to the influence of hereditary factors, either in time or power. It is of interest to note that every bird may have, unless in-breeding has been adopted, upwards of two thousand ancestors within ten generations, and more than sixty-five thousand progenitors in fifteen generations, each of which had its own individuality. As a matter of fact, by reason of the interchange among breeders, between many of these ancestors there must be a measure of relationship, so that the numbers

stated are excessive. At the same time, that in itself adds to the breeders' difficulties, as any special character or quality found in a number of these progenitors will mean the inheritance is stronger in that direction. On the other hand, there may be forces which are struggling for mastery, making their appearance from time to time. It is through the egg that the parents, immediate or remote, transmit to the progeny what they themselves possess or possessed. Size and shape of body, the nature and colouration of the plumage, build and texture of the skeleton and muscles, functional activities, measure of physical vigour, and even tendencies to and power of resisting disease, are inherited. Were it not so, breeding would be an absolute gamble in which there would be no degree of certitude. In some of these the influence is comparatively weak. That which has been last added is most easily lost. Whatever has characterised the family for a long period is most potent. For example, among some breeds of non-sitters, even though that is merely a suspended function, it is exceptional to find a hen showing the maternal instinct.

VARIATION

Inheritance itself tends to variation, in that characters or qualities which, by selective breeding or other influences, have been dormant may unexpectedly make their appearance. This atavism, or reversion, as it is called, cannot be explained, much less why it should exert itself at one time and not at another. It is a reassertion of what has been repressed. Possibly the repression has led to a renewal of vigour. There is, however, another factor tending to greater variability, namely, change of conditions, such as climate, soil, elevation, and food, all of which afford an explanation of many variations. A harsh, cold soil hardens the bone

and muscle ; a warm, kindly soil has the reverse effect ; a higher elevation, with its exposure and lower temperature, decreases size by retarding growth ; differences in food, more especially that obtained by foraging, has its effect upon the flesh ; and hens in the northern temperate regions are better layers than in the warmer areas. Colour of plumage is affected in this way least of all.

ENVIRONMENT

Sanitation and hygiene are as essential to poultry as to human beings. Unless there is purity of atmosphere and regular circulation of fresh air, night and day, the floor of the house in which the birds have to sleep or the ground upon which they run are untainted by whatever is harmful, the birds protected against attacks of bacteria and parasites, and the water which they drink is clean and fresh, health cannot be maintained. Whatever the purpose for which the poultry are kept, health and vigour are essentials. There are, however, other factors which are part of the environment, such as cleanliness and opportunity to obtain whatever exercise is demanded for maintenance of functional and physical activity in accordance with what is required of the birds, and to keep them in perfect health. In this respect there are great differences. An exhibition fowl does not require more than a modicum of exercise, otherwise it will become rough in feather ; a chicken or other poultry intended for early killing makes more and softer flesh when it does not use its muscles too much ; breeding or laying stock require as much exercise as possible, otherwise they do not lay so well or supply, in the first place to the eggs fertilised or laid by them, the elements needed for production of strong, virile chickens. Temperamentally some breeds are nervous and require more exercise than those

which are of a quiet disposition. In all cases there should be no sense of restriction.

IN-BREEDING

Mating together for breeding of birds related to each other is very largely practised by exhibitors and those who are seeking to improve racial characteristics. The object is to reduce variation as much as possible. As a fact, this practice appears necessary to fix characteristics in new breeds and varieties and to obtain greater uniformity of colour, feather-markings, etc. That there must be a considerable degree of consanguinity among wild animals and birds is unquestionable. Under a state of nature, however, not only is there development of vigour by constant exercise in seeking for food, but drastic elimination of the less fit and absence of any forcing, whilst no strain is imposed upon the powers by increased productivity. What, therefore, may be the rule in that case does not apply under domestication, where the conditions are totally different. Among utility poultry, more especially where efforts are made to increase egg-production, close and what is termed line-breeding, which is merely a regularised modification, have been adopted with very doubtful results, owing to the fact that these tend to refinement and reduction of the physical vigour. The results achieved, therefore, are more than doubtful. In-breeding is a practice which should only be adopted in any case by those who possess skill as breeders.

CONSTITUTIONAL VIGOUR

Domestication involves artificial conditions and tends to reduction of the physical powers, even though there may be an improvement in many directions, such as size of body, greater perfection of characteristics, production of eggs

and flesh. Therefore special attention requires to be given to the question of constitutional vigour. Some very interesting experiments have been carried out in America in this direction. At the Cornell University, in the State of New York, for three years chickens were chosen which, so far as external appearances were concerned, showed in one case great vitality, and in the other a measure of weakness, neither of which, however, in extreme. The result, in so far as the chickens bred from both lots, as to fertility and hatchability of eggs, cost of food in rearing, and the number raised to adulthood, are concerned, have all been in favour, as one might have expected, of the more vigorous birds. In some cases this was much more marked than in others. It scarcely needed, however, an experiment of this kind to prove what must be evident, namely, that in selecting birds for breeding purposes very great attention should be paid to the natural vigour and thriftiness of body. Where the mistake is often made, more especially by smaller breeders, is thinking that all birds are fit for breeding purposes. That in itself is a very great error. The true principle is only to hatch in this way from the best, regarding that designation in a very broad sense. As a fact, out of a flock of birds, unless these have been strictly selected, not more than 10 to 20 per cent are fitted for breeding. The best does not mean most perfect in racial characters, nor largest in size of body, but the most vigorous and more perfectly balanced in all points. For exhibition purposes it is frequently true that some of the more delicate birds are the most perfect, so far as plumage, etc., are concerned, just as the finest blooms on a rose tree are not necessarily those that would be most valuable for reproductive purposes. The first point in selection, however, whatever the object in view, should always be constitutional vigour. No

bird, however good in other respects, should be selected if it fails in that quality.

EFFECT OF SPECIALISATION

What is stated above naturally leads to record of a fact which is within general experience—namely, that specialisation in any one quality and its greater development is always at the expense of others. We do not expect the thoroughbred horse to be fit for draught purposes like the hack, much less is it usable in a dray. Nor do we find that the heaviest milkers in cows produce the finest or greatest amount of flesh. Such is also the case in poultry. Increase of fecundity is accompanied by decrease of weight and lessened quality of flesh. On the other hand, an improvement in size of body and of muscular development tends to reduction in the number of eggs produced, though perhaps not to the same extent. Such must be recognised wherever there is specialisation. Where larger operations are attempted or semi-intensive methods adopted, this result will follow. As poultry husbandry advances specialisation will become more necessary than ever. Consequently choice of the right breed is essential. These observations do not necessarily apply to ordinary farmers, who often find that what may be termed a composite fowl is most suited to their demand. By that term is meant those known as General Purpose fowls, in which, whilst some at least are fairly good layers, they carry a considerable amount of flesh, though not of the finest quality, and are heavier in body than the egg races.

PARENTAL INFLUENCES

Every fowl, as already seen, inherits whatever qualities it may possess from its ancestors, which, however, in certain directions may be modified or influenced by environmental con-

ditions, so far as the individual is concerned. In every generation the immediate parents must be most potent. It is desirable, therefore, to understand, so far as known, whether these have exceptional influence upon the progeny. Stock-breeders have always stated that "the male is more than half the flock." Although this view for a time appeared to be in doubt—namely, after adoption of the trap nest, further experience has shown, even in the case of egg-production, which is purely the work of hens, that the male determines to a greater extent than the female the laying quality of their progeny. This does not mean that the last named may be ignored, but that any family characteristic is transmitted more through the male than the female. Generally speaking, it can be stated that breeders must look to the male for maintaining and improving racial characters, colouration of plumage, size of body, and productivity; whilst the female parent is specially concerned with the temperament, vigour of constitution, owing to the fact that she supplies the material elements of her eggs, and maternal qualities. What should, however, be sought for is an equal contribution, as far as that is possible, from both parents.

SIZE OF BODY

The exhibition system in one direction has been on entirely wrong lines, in that standards adopted have arbitrarily modified size of body. On the one hand, with the diminutive races known as Bantams the object sought for is to obtain these as small as possible. Thus a 12-oz. specimen is regarded, and is a more perfect specimen of the breeder's art, than one twice that weight. On the other hand, with heavier breeds large size is equally potent. Hence it is that in nearly all classes of stock intended for exhibition breeders feed for size of frame and

increase of flesh because these appeal strongly to the judges. Where animals or birds are intended for killing, securing the greatest proportion of edible meat to the total weight is economic. Therefore, in what are termed Meat Breeds greater capacity for flesh development is desirable. Even with these, however, the birds intended for use as breeders should be moderate in size, in lean, hard condition, yet capable of carrying a large quantity of muscle. It is found, almost without exception, that the most prolific hens are under the average of their breed in size, and that when in full lay they do not carry a surplus ounce of flesh. Whatever the object in view—exhibition, egg- or flesh-production—the breeding stock should always be in hard condition.

AGE OF BREEDING STOCK

Under domestication fowls and ducks do not attain their maturity, and therefore full size of body, until nearly two years old; geese and turkeys a year later. Fecundity and the power of reproduction are at the maximum immediately prior to that period. How long these continue will depend upon many influences. In some cases years elapse before there is a cessation of breeding power as distinct from egg-production, which are not the same. Fertility, however, is usually higher when birds are young as a result of greater physical activity. At the same time, hatchability of eggs and vigour in the progeny is generally less than when parents are mature.

For exhibition stock use of birds for breeding may be continued over a long period of years. The same is true with birds intended to produce chickens or other poultry for killing, though younger birds are preferable, in that with increasing age the time when hens commence to lay each season is usually later. For amateurs

who are only able to keep a comparatively small stock other considerations enter—namely, that a supply of eggs for the household is of importance, in which respect one- or two-year-old hens are more productive than those which are older. The ordinary farmer and commercial poultry-keeper should limit the number of his birds of lesser productivity to those required as breeders. Under such conditions experience has shown that for the production of vigorous chickens parents two and three years old give the best results. Pullets and yearling males should not generally be used in this manner.

DURATION OF PROFIT

Whoever is making a business of egg-production must regard output in relation to the costs. It is, therefore, important to know how long birds should be retained, that is, the period of profit. Generally speaking, where, by methods to be afterwards described, pullets are bred, grown, and fed to secure laying at an early age, that is, by stimulation of the fecund quality, these produce a greater number of eggs in the first than will be the case during successive years. For that reason attention has been largely concentrated upon pullets, by which term is meant those ranging from five to fifteen months. With these remarkable results have been achieved. In a few instances individual birds have laid up to 300 and more eggs in twelve months, though these are very exceptional. What may yet be achieved in this way is uncertain. Hens have been proved to carry in their ovaries from 1700 to 3500 öocytes, that is, potential yolks. Up to the present time few records have been made of any hen producing a thousand eggs in her lifetime. Investigations have shown that, with exceptions, the period of maximum production is three years. Normally, over that period production will be fairly dis-

tributed more, however, in the first year and steadily declining. If the number be large in the first period, such reductions will be greater in the second and third. With fewer eggs during the pullet stage more may be expected later, when size and quality are higher. In this way three years may be regarded as the duration of profit as producers of eggs.

HIGH FECUNDITY AND BREEDING QUALITIES

Excessive production over that which is normal makes demand upon the system and in relation to its degree. Such fact is unrecognised by the great mass of poultry-keepers whose experience in or knowledge of breeding is very limited. Disregard of essential factors has led to very serious results. It is not too much to say that the marked diminution of vigour in several of the most productive breeds and varieties of fowls, and the great increase in embryonic and chick mortality, are in large measure due to neglect of what has been long known with larger stock, and also the more experienced breeders of poultry. In this connection are two principles which should be remembered by all—namely, first, that high fecundity or greater size of body, above the normal in each case, impose a great strain upon the entire system, in the former by reason of its continuity over a prolonged period of time, from which the birds never fully recover and which has lasting influence especially upon the process of reproduction; and, second, that even where egg-production has not reached a high standard above the normal the time of maximum production is not when the forces involved are most conducive to a high standard in the progeny. High fecundity and breeding qualities are, therefore, in antagonism when the former of these is exceptional.

ELEMENTS OF EGGS

Nature has provided that, in the case of birds, the egg shall be the basis of reproduction. In that is contained the new being in embryo, consisting of a living because fertilised germ, very small but with a wonderful power for development and growth under favourable conditions. Without application of heat it dies of inanition. From the fact that, unlike mammals, it is voided by the mother whilst an undeveloped embryo, it must be provided with materials from which the body can be built, and with food during the stages of development within the shell. The former are contained in the albuminous portions—namely, the white, and the latter from the yolk. Whether the embryo can grow with capacity for making a strong, hardy chick and adult bird depends in large measure upon whether white and yolk contain the required elements in sufficient quantity and proportion. Thus arises a question of vast importance respecting which no investigations have been made. We know ovarian activity can be largely increased and that a much greater number of eggs can be produced. That is within general experience. The question is whether the supply of elements which go to formation of the albumen is increased correspondingly. We have no knowledge that such is the case. As a fact, evidence available is to the contrary. If such is correct, there is explanation why high fecundity and breeding qualities are not found at the same time in the same bird. Unless there is a correlative increase in both directions, a hen which is able to produce sufficient albumen during the breeding period for, say, 50 eggs will have to distribute the same amount over 100 eggs, if she lays that number, so that each egg will be deficient in body building elements.

QUEST OF THE EXCEPTIONAL

At the same time, it is evident that in plants, animals, and birds there are occasionally found individuals which possess greater capacity in all directions than that which is general. Several of the most valuable breeds of stock have been developed from such exceptions, of which the Bates Shorthorn in cattle is a leading example. In this way a new standard is raised. Breeders are constantly at work seeking to discover birds not merely possessing exceptional characters or qualities in themselves, but with the power of transmission, which is a totally different question. Generally speaking, as any bird or flock exceeds the average of its family its progeny fall below it, so that the mean is maintained. Apart from the effect of environment and control, which are distinct from breed tendencies, what is here stated is in conformity with general experience. In this direction breeders for exhibition have attained the greater success, probably due in large measure to the fact that a severe physical strain is not imposed by increased productivity. With exhibition stock the greatest danger is an increased size of body. What is here indicated is the work of stock-breeders, who may find it profitable to undertake, in spite of the risks and difficulties. The work is beyond the ordinary poultry-keeper.

RANGE OR RESTRICTION

Whilst the question of environment is discussed in the next section, it has to be regarded so far as its effects upon breeding is concerned. In this connection one of the problems presented for solution is the risk inseparable from more or less intensification of method, especially in connection with possible degeneracy of the stock. Much of our poultry is kept and bred

within small yards throughout the year, or at any rate during the breeding season, undoubtedly tending to weakening of the system. Such may not be evident in one or even two generations, but if continued over a series of years is bound to exert an influence. Not much harm is done if the fowls are at full liberty during the rest of the year, and simply put into runs, say, for eight or ten weeks as eggs are required for hatching. This system may be adopted with advantage, although the better plan is when the laying birds are in pens during the breeding period and the breeding stock given their full liberty. If poultry-keepers have not sufficient room to carry out such a plan they must be prepared under those circumstances to obtain fresh blood from birds which are kept on range, otherwise degeneracy will speedily follow. Wherever possible, as much liberty should be given to the breeders as is available, and even to go out of the way to secure so desirable a condition. Another point which may be mentioned in this connection is that many people, even those who are able to give their birds full liberty, do serious harm by overfeeding or supply of unsuitable foods. Where birds have free range the amount of supplied food they require is comparatively small, and as exercise tends to increase of natural vigour, the more they have to work for the food the better will it be, as well as the cheaper. Greater results are obtained with birds at liberty upon fairly good land if they are only given one feed a day—namely, in the afternoon, and entirely of corn. The main factor, however, is freedom and range.

FORCED STOCK

Reference has been made above to the fact that high fecundity and breeding qualities are not generally compatible, in that an excess in the former direction means a reduction of the

latter. Nature endeavours to maintain a balance, to upset which involves corresponding drain upon all except that which gains by the process. To provide adequate food supplies intensive methods are essential, otherwise shortage must result. Intensification is a process of forcing. Much can be done in this way. The wild hen only lays a couple of dozen eggs per annum and for reproduction of the race. Under domestication by a variety of influences, of which removal of eggs from the nest as laid is merely one, although very powerful, the average in some breeds has been raised to 120 eggs per annum and more, and small flocks have gone well over 200. This process extended over generations, in some cases centuries, has modified profoundly the fowl in the way of increased production. The same is true in respect to flesh qualities. Moreover, under natural conditions the laying period is restricted to the spring months of the year, during what is the breeding season. Muscle—that is, edible flesh—is most abundant in the autumn months prior to the advent of winter. Unless there was extension of production beyond these periods, both eggs and flesh would be seasonal products. Forcing has, therefore, to be resorted to and is desirable for attainment of the increases required, so long as the birds subjected to it are not used for breeding. They are called upon for a very heavy output, which is a tax upon the system.

SIZE OF EGGS

One of the effects of greater production by the individual hen is to reduce the size of eggs, respecting which there have been many complaints within recent years. In this direction some breeds are more pronounced than are others. Upon this point very interesting observations have been made at the West Virginia

(U.S.A.) Agricultural Experiment Station—namely:

(1) The heavier the egg, the heavier the yolk.
(2) The heavier the egg, the smaller is the percentage of the egg that is yolk.
(3) When eggs are laid in cycles (that is, successively without any intermission of a day), the first egg in the cycle is usually the heaviest, the other eggs decreasing in weight according to their position in the cycle.
(4) The weight of the yolk usually decreases according to the position of the egg in the cycle.
(5) In general, the first egg in all cycles has a lower percentage of total egg that is yolk than has any of the other eggs.
(6) The eggs laid by individual hens not only vary widely in regard to their average weight and the average weight of their yolks, but the average percentage of the total egg that is yolk also varies widely.

It is evident from the above that Selective Breeding is essential to maintain size of egg, most of all with hens that are heavy layers. That is one reason why pullets' eggs should not be used for hatching, or any which are undersized.

TRAP-NESTING

Whilst a great mistake is made in using the heaviest laying hens as breeders, it is desirable to know which are the most prolific, in order to test the family records and to discover those that are of low productivity, which should be avoided in the breeding pen. By elimination of poor layers the average production of a flock can be steadily raised and maintained. Hence, adoption of what is known as the trap-nest, which is a very valuable apparatus for those

who are able to give the necessary time required in liberating the birds. This must be done several times per day. Of trap-nests there are many forms sold by poultry appliance makers. The principle in all is the same—namely, that when a hen enters for the purpose of laying, in the doing so she liberates a trap-door and cannot get out until released. The attendant on opening the nest, if she has laid, marks a laying register provided for the purpose, and if she has a numbered leg-band he usually marks the egg as a further record. The trap-nest is then reset. In this manner the laying of each individual hen can be told either for a year or a portion of it. As the hens which lay best in the four winter months, October to January, are, almost without exception, the highest producers over the entire year, many breeders only trap-nest for three or four months. The system entails a large amount of labour and does not pay the farmer or household poultry-keeper.

THE HOGAN SYSTEM

A method which has been extensively advocated, especially in America, is known by this name. The claim is made that an indication of the number of eggs which a hen will lay is the distance between the pelvic bones embedded in the flesh above the vent and the posterior end of the sternum or keel. That there are differences in this respect is undoubted, and that the heavier layers are wider than those which are poor is an unquestionable fact, owing to great expansion and use of the parts, varying from a one- to four-finger measurement. Whilst, therefore, the system has a physiological basis, it has not proved possible to apply rigidly in anticipation of the laying period. Whilst a guide, with limitations, the consensus of experience is that other factors have an equal importance in determining how many eggs a hen will produce,

and that whilst type is generally an indication of whether it is built for egg or flesh production it is uncertain in application.

CULLING OUT THE NON-PRODUCTIVE HENS

No bird should be kept a day longer than it pays for its keep, immediately or prospectively. Individual profit and national economy demand that there be no wastage in any direction. During the summer and early autumn the older hens, those which are not intended to be retained over another year, should be regularly and systematically culled out, and such as have stopped laying immediately got rid of. The saving of feed by this process is considerable. Generally speaking, the early moulter is the long moulter and the poorer layer. Moreover, even where, as in the case of two-year-old hens, some may be kept another season, and wisely so, it is desirable to be able to decide which of these to retain in that they are the most productive. Those who trap-nest their birds are able to do this. That system, however, is too laborious and expensive for the greater mass of poultry-keepers, and can only be profitably adopted by such as make their money by breeding stock for sale.

Fortunately there is a method, at once simple and effective, by means of which, in the case of yellow-fleshed and legged breeds, the time when laying has ceased can be determined. It is commended to all those who keep Leghorns, Wyandottes, Plymouth Rocks, or Rhode Island Reds. Such system is based upon natural changes and is in no sense artificial.

Careful and prolonged investigations have shown that in the case of these yellow-fleshed breeds the colour of the skin, shanks, beak, and ear-lobes becomes paler during the period of laying, and the greater the productivity the more is their loss of colour. On the other hand,

when the hen ceases to lay there is a rapid resumption in colouration of the parts named. Further, that when a hen is in full lay not only is the skin around the vent pale, but this organ and the surrounding parts are soft. So soon as she ceases to lay, in addition to return of the yellow colour, the part becomes tight and firm. The loss of colour referred to is apparently due to the fat underlying the skin, and which gives the yellowness to it, being drawn upon to supply the yolks with that essential element. When yolks are no longer being developed fat is again stored, thus explaining why the colour returns. The changes here indicated have long been known, but only recently have their significance and economic value as a help to the poultryman been recognised.

In practice the application of this system is that from June to September the flock of hens should be examined monthly for colouration of the parts referred to and state of the vent. Those which are wholly or partially pale in colour of skin, etc., and with moist vents, are still laying. Greater density of colour in grades until completely yellow is indicative that the birds have ceased to lay for a shorter or longer period and are not likely to be productive again for some weeks or months. These, in the absence of any special reason for retention, should be culled out. They are the productive hens no longer.

AVERAGE PRODUCTION

Profit in any direction is determined by the average, not the exceptional production. That is true with exhibition poultry, though to a lesser extent than among utility stock. In the latter a few birds which may produce far in advance of the entire flock have very little influence upon the annual balance-sheet. A fact that is proved by long experience in all coun-

tries is that the average is maintained to a remarkable degree. As example, in relation to laying it has been found that if the average of a flock of 100 hens be, say, 150 eggs per annum, there will be practically as many below as there are above that number in annual production, even to a remarkable degree. A few may yield 200 eggs each in twelve months, but there are almost always as many down to 100. Not to breed a few exceptional birds, but to raise the average, is the line of greater profit. Many have failed, more especially in egg farming, because they have based their costs, expenditure, and returns upon the performances of a few birds, expecting that the same production could be secured from all.

WINTER LAYING AS A TEST

Not only is it important to secure as far as possible an increased number of eggs during the winter period, because the produce is then of greater market value than in the spring, but also those hens which are most productive at the former season give a larger yield over the entire year. This may be illustrated by results attained in the Harper Adams Laying Trials of 1918–19, as follows :—

Average annual production of 53 pullets laying no eggs in 8 weeks ending December 28th	175·7
Average annual production of 51 pullets laying 1 to 10 eggs in 8 weeks ending December 28th	170·5
Average annual production of 40 pullets laying 11 to 20 eggs in 8 weeks ending December 28th	188·6
Average annual production of 23 pullets laying 21 to 30 eggs in 8 weeks ending December 28th	196·6

Average annual production of 19 pullets laying 31 to 42 eggs in 8 weeks ending December 28th . . . . . 215·7

SELECTING THE BEST LAYERS

Various methods have been suggested as to how the best laying hens can be selected for breeding purposes. Although many of these have broken down in practice we have arrived at something like a better understanding of the problem. In an interesting bulletin published by the Department of Agriculture of the State of New York, the following suggestions are made :—

"Manifestly, the trap-nest is not feasible for farmers nor for poultrymen generally, although it must be used by breeders. Therefore we must find some physical indication that will help us to recognise and select our highest producers. We have discovered in investigations at Cornell three or four principles that we can with perfect confidence recommend to poultry-keepers as guides in the selection of their most prolific stock.

"The highest producers moult late. The first physical character and the most valuable of all in selecting hens for breeders that are high producers is lateness in moulting. The hen that is born to lay a large number of eggs, if well fed and handled, will generally follow the line of least resistance and continue to lay, and thus fail to perform the natural process of moulting. This is because she has so much reserve power that she continues to lay, and as a result her feathers do not die and loosen. Although the comparison is not perfect, the same principle really obtains if we compare a late-moulting hen to a strong, vigorous apple tree that has been well sprayed. The leaves, like the feathers, continue to grow past their usual season and hang on the trees up to the winter time. Hens

that have laid only 25, 50, or 75 eggs have, in almost every instance, moulted during the summer—in July, August, or September. They do not necessarily start laying again in the fall or winter simply because they moulted early. The hens that moult late take the shorter vacations and begin to lay early again.

"High producers are heavy eaters. Watch the hens and see them eat, and observe how they act; it will help to pick out the laying hens in the autumn and winter. The hen that is the heaviest layer is generally the one that is eating the most food. She goes to roost late and gets up early."

SEPARATE THE BREEDING STOCK

Many poultry-keepers, especially farmers, fail to apply to their fowls the same principles that would be the case in the breeding of larger animals—namely, careful and rigid selection both of sires and dams. In the case of poultry the plan is all too common of breeding from the entire stock, even where some attention is paid to the selection of fresh male birds. Such a system absolutely eliminates that degree of selection which is the basis of all successful breeding. There is no guarantee that the eggs chosen for hatching are from the best birds; in fact the chances are considerable against such being the case. For instance, if, say, the flock of hens consists of fifty birds and three or four males are introduced amongst them, that will probably secure fertility in the eggs. It may be, however, that the hens which are best as breeders will only number, say, twenty out of the fifty, and therefore the chances are six to four that the eggs will be obtained from the least satisfactory mothers, although all the male birds may be good in their quality. Such an arrangement everyone would condemn if they thought about the subject. Therefore the plan

to be adopted is that hens which are chosen as breeders should be separated into flocks of ten or twelve from the others and mated with a carefully chosen male. That is not at all difficult to carry out. They should be placed in a house away from the others. Upon a general farm this had better be a considerable distance from the general stock. Their eggs alone should be used for hatching purposes.

In making a selection of hens there are several points to be kept in view. (1) As far as possible these should be over year birds, which usually ensures a much greater degree of vigour in the chickens; (2) it is well to select the hens which have proved to be good, not exceptional, layers—that is, where egg-production is in view, or, in the case of table chickens, those from families which are known to produce quick-growing chicks; (3) constitutional vigour, as indicated by activity of habit, should always be regarded.

SELLING OLD HENS

It is a mistake to keep hens too long. Those which are to be sold should be got rid of in the latter part of June or early in July each year, for the reason that there is a demand for birds at the season named, more especially where is a large Hebrew population. These must, however, be sold alive, because in accordance with Jewish ritual birds undergo an examination before they are killed. In the months mentioned there is always a very large demand for birds of the class which are mainly used for boiling, and for which good prices can be realised. Upon an economic basis, therefore, it is a wise policy to sell at the season named, even though the hens be laying. Frequently is an objection made to selling hens whilst they are in profit, forgetful of the fact that in many cases they will soon fall into moult, and, of course, are no good for killing whilst that process is

going on. It has been estimated that the loss by keeping these hens until, say, October, will frequently be equal to about 3s. to 5s. each. A further consideration, especially where the amount of space is somewhat limited, is that by getting rid of the older birds there is more scope for the young and growing chickens. That point should never be forgotten. Chickens grow much more rapidly when they are not mixed with older birds.

BUYING STOCK BIRDS, EGGS FOR HATCHING, ETC.

The surest method for beginners is to purchase adult birds for breeding, and to pay a reasonable price for good stock rather than obtain what is cheap and doubtful. The inexperienced must trust the vendor rather than his own judgment. Values are variable because these are abstract. Breeders with an established reputation command much higher prices than those who are less known, for the reason that it is assumed their stock has been carefully selected for years and is more reliable.

In buying stock for the purpose of breeding exhibition birds the primary way of success is to secure the best that can be obtained. Much depends upon the quality of the birds and, even more, the way in which these are mated. The process of learning is slow yet fascinating, and the chances are considerable.

Buying eggs for hatching is a cheap method of commencing or renewal for utility poultry-keepers operating upon a small scale. There is, however, much in the way of chicanery practised. Purchasers also are often unreasonable. They do not buy chickens, but the possibility of these with all the risks involved in the process.

The trade in day-old chicks has increased enormously within recent years. Upon that more information is given in a later section.

Section III

ENVIRONMENT

CONDITIONAL INFLUENCES

Without favourable conditions and a hygienic environment health cannot be maintained or success achieved. However great the potentialities of fowls or their capacity for productivity, these are unable to find expression unless the surrounding influences contribute to the result desired. There has been a tendency to ignore or to minimise the importance of these factors owing to the amount of attention given to heredity, which, powerful though that may be, is but one of the influences at work. The adaptability of all forms of animal life is remarkable. Yet we know by long experience that, as a result of different conditions, productivity varies to a very large extent, explaining much that is otherwise difficult to understand. A very common error has been in assuming that atmospheric heat is conducive to egg and flesh production. That there must be a measure of warmth is evident, but excess of heat or cold is a hindrance. This is a reason why the temperate zones are most favourable to live stock and to the highest quality. Climatically for poultry the British Isles include the most suitable countries in any part of the world. The old notion of keeping roosting-houses warm during winter, either by application of artificial heat or by checking effective ventilation, has proved an economic blunder. At the same time, there must under domestication be adequate protection.

Many misconceptions are general as to climate. In spite of its vagaries, there is no finer climate in the world than that of the

United Kingdom. Its atmospheric moisture, taking the place of excessive heat and cold met with elsewhere, makes for temperate conditions and maintains herbage and plant growth all the year round, as well as the lower forms of animal life which are valuable as food for poultry. Water below the feet is bad; above the head it is good if not excessive.

SOIL

Much more potent is the effect of soil, the nature of which should determine the class of fowl to be kept. This appears to be due to two leading causes—namely, retention of heat and moisture respectively. Sandy or gravelly soils not only absorb and retain heat more rapidly than those which are heavier, but their porosity allows moisture to pass through rapidly, and they are consequently drier. Not only so, but darker-coloured soils absorb heat to a greater extent than that which is light coloured. Light, well-drained soil is warmer than that which is heavy and dense, as the last-named requires more of the sun's heat to raise its temperature and evaporate the water in it than the former. As a result it is always colder, affecting the birds more than does the air temperature. Further, growth is much slower on heavy soils, for which reason the finest chickens and other poultry are produced where the earth is kindly and light, and the flesh is finer and softer. For these reasons upon heavy lands the stock must be hardy, vigorous, and active, and egg-production is the line of greatest profit. For table fowls this class of land is unsuitable. Where poultry are to be kept extensively, whether on farm or commercial lines, the question of arable *versus* pasture land is of importance. Divergent views are held. It is evident, however, that where the ground is ploughed more birds can be maintained per acre, as there is less danger of con-

taminated soil than if in grass. Under such conditions, as it is desirable to grow as much feed for the poultry as possible on the spot, it is evident that the weight of evidence is in favour of arable land. To the smaller poultry-keeper the question is of lesser importance.

LAND AVAILABLE

Extent of operations and methods to be adopted must be determined by the amount of ground available. On farms and where there is abundance of space other factors, such as labour, enter. Those who are compelled to work under restricted conditions require to give careful consideration to what is here stated. Many failures arise from attempting too much—that is, endeavouring to keep a greater number of stock than the space warrants. Five hundred, even a thousand, birds have been kept per acre, but only for a short period. Disease and loss follow as a result of contaminated soil. The exhibitor-breeder is least affected in this way because his profit and success are derived not by the number, but the value of the birds bred. Therefore he is not tempted to risks in the directions indicated. Upon utility lines numbers count. Hence, except in respect to intensive methods dealt with below, the land available, whether in garden or paddock or field, should be divided between that which is cropped and such as is occupied by the fowls, changing at regular intervals, and never attaining the maximum of capacity on the space so used. Success with twenty birds may be possible where fifty would mean failure. With one or two exceptions, land is as necessary as are air and food.

DISTRIBUTIVE METHODS

For the farmer and larger operator the distributive method is preferable and most profit-

able. By this is meant that the birds are divided into smaller flocks, say twenty-five to fifty, each of which is accommodated in a house that by its size and structure enables it to be easily removed from one field to another as required in accordance with cultivation. On arable land such changes of position may be at longer intervals, and, as a fact, fowls allowed access to growing crops do more good than harm by destroying parasites and consuming various seeds. When upon grass land removal must be more frequent, otherwise there will be injury to herbage by the house and by the fowls treading around. The advantages of this system are that the cost of equipment is comparatively low. Even with the present high prices of materials this should not exceed 10s. per inmate, at any rate, for the larger sized flocks. Everything is simple, and use of wire-netting and many appliances is avoided ; expense of feeding is also low, as the birds, when upon good land, obtain a considerable part of their nutrition by foraging ; and there is no risk of soil contamination, as manure is distributed and rapidly absorbed by the land, yielding in this way high returns in the crops grown afterwards. The disadvantages are that in many districts the risks of loss by foxes are considerable, as it is necessary to close up the houses in the early evening and to open them again in the morning, involving labour in that way. That is, however, to some extent compensated by lesser work than necessary when massed together. The average of egg-production is usually less than upon commercial lines. Under such conditions to increase winter egg-production the provision of a large scratching-shed for the laying flocks of pullets would make for an increase.

THE COLONY SYSTEM

A method which has proved most successful both in this country and America is also based upon definite relationship between the poultry and cultivation of the land, but is more intensive. It has the advantage of concentration without adding to the equipment expenses by erection of fences or wire-netting. It implies that over sections of the land poultry are kept very thickly for, say, a period of twelve months, and as a consequence it is most suitable for arable farms. By such method it is possible to keep two to four hundred hens per acre—that is, upon the ground actually occupied by them. If these were retained on the same ground for a longer period there would be grave danger of the land becoming tainted, due to the accretions of manure, which explains why using the same ground continuously for poultry is frequently fatal to permanent success. When occupied in the manner referred to for the time named, no harm is done if the land is fairly good. During the period stated a large quantity of manure is produced, and the object should be to turn this into money, which can only be accomplished by cropping. As a consequence, therefore, at the end of, say, twelve months the whole of the fowls are entirely removed on to fresh ground, where the process is repeated and is given up wholly to them. That vacated should now be cultivated in any way that is in conformity with the nature of the soil and the general system of the district. It will take, even with full cropping, three years or more to outgrow the manure put into the ground by the birds and restore it in other ways to conditions that will be suitable for occupation by them again. Thus a colony system forms a part of regular rotation. There is little doubt that if this method were adopted by farmers more generally it

would conduce to a great increase of egg and poultry production. Where adopted it has proved most successful. For effective control, however, special labour is essential and the work be organised as on dairy farms.

ROTATION SYSTEMS

The same principle may be adopted upon small holdings, allotments, or large gardens, but varied in that to prevent injury to crops it is necessary to keep the fowls within enclosures, thus adding to the capital expenditure. The same is also true upon market gardens. Where the land is dug or ploughed, as many as four hundred hens can be kept per acre actually occupied. The space, no matter what the area, should be divided into four equal parts, one of which will be used each year for the hens and the other three be cultivated. In turn each section is thus occupied under a regular rotation. A fact should always be remembered—namely, that as the number of fowls is increased per acre so must cultivation be intensified. The gain, however, by increase of the crops produced is very great and all danger of contamination is removed. In addition to the space named, provision should be made so that growing stock shall have a larger amount of liberty and be kept distinct from the older birds.

SEMI-INTENSIVE METHODS

Where commercial poultry husbandry is adopted on a more intensive basis a different method has proved very successful, in which there is still maintained the relationship of a measure of cultivation with the poultry, though to a lesser degree than described above. There is, however, a fundamental difference in that what is known as a Scratching Shed is always used, affording an opportunity for the birds to remain under cover contentedly, finding there

not only food but exercise by scratching in litter for grain. Such houses are described below. As a consequence the birds spend a comparatively brief period of the day outside, and thus the soil in the runs is not used to the extent that would otherwise be the case, or does as much manure fall upon it, so that the danger of soil contamination is considerably reduced. Whether sufficient time has elapsed to determine how long land can be occupied in this manner has yet to be proved. The line of safety for those who operate upon semi-intensive lines is to so plan their ground that more land can be given if required, even to the extent of removing the poultry entirely from it for a period of three years. Too much land one can hardly have ; often too little.

Much controversy has arisen (1) as to the most profitable number of fowls within a flock, and (2) how many can be kept per acre under this system. It is undoubtedly correct that, as a rule, large flocks do not attain the same average egg-production as when hens are in smaller groups. At the same time, the primary cost of housing per inmate is greater when in units of, say, 25 or 50 in comparison with those of 100 or 200 or more. Experience alone can decide the point. Even if there is some loss in average egg-production, should that be more than met by saving of capital and renewal charges, there is a gain. The profit and loss account must decide all such questions. One very large poultry farmer states that he finds 150 hens the most profitable unit. His birds are kept upon grass and in numbers as stated to each acre. Each house stands upon an acre of land, which is divided into two-acre plots—that is, every group of four of these houses have two enclosed runs of two acres each, which are used alternately, changing every six months. It may be stated as important that grass land

must either be mown regularly or fed off with sheep to keep it short, otherwise it grows rank and coarse, which in turn prevents exhaustion of the manurial elements. Another equally successful egg-farmer adopts 400 as the unit of his laying flocks, and only allows these an acre, divided into two runs for alternate use. This, however, is arable land, and as each section is vacated it is planted with rye or kale. In the eastern and western sections of Canada and the United States arable land is preferred, and has the advantage of producing heavy crops for feeding the fowls.

INTENSIVE SYSTEMS

As indicated above, domestication involves intensification. How far that can be extended is undetermined. Much depends upon the nature of the animal, more upon how far reaction can be checked. We have to remember that adoption of the methods which are so designated, whilst responsive in yielding a much larger return of food, such as eggs and flesh, are not conducive to maintenance of the reproductive faculties, which may be weakened thereby. Exhibitors have shown how much can be done in this way. They, however, do not aim for heavy production, and, by drastic culling out of the birds from the earliest stages, get rid of such as fail to reach the standards set up. A continuance of artificial methods in successive generations often leads to ultimate degeneracy, as indicated by the way in which some breeds of exhibition stock have deteriorated in vigour and productivity.

Wherever the amount of space is small in thickly populated districts the systems of poultry-keeping must be highly intensive. That is true of the great majority of household flocks kept in small gardens and backyards. Remarkable results have been attained under these

conditions. From half a dozen hens of the right kind, and managed properly, it is possible to obtain about a thousand eggs in twelve months and at a comparatively small cost, as the birds are largely fed on house scraps. These may be accommodated on a small space of ground, say, 60 square ft., provided that the soil be renewed by fresh sand or earth four times annually, or in one of the small intensive houses, about 6 ft. by 4 ft., in which case the floor must be thickly littered with cut chaff or dried leaves and renewed frequently, forming a scratching material in which grain is buried. Under both sets of conditions regularity of attention and absolute cleanliness are essential. Further, birds so kept should never be used as breeding stock, but be replaced by purchased pullets as required. For larger operations the high cost of equipment and large amount of labour involved under the intensive system precludes it from being in any sense a commercial proposition.

HOUSING OF POULTRY

The object of providing houses for poultry is protective, to keep them under direct control, to compensate denial of the opportunities for changing location which is instinctive, as the seasons and conditions vary when under natural conditions. If fowls were permitted to follow their inclinations and roost in the trees they would be healthier, but less productive. Increased production is essential in order to meet the higher costs of maintenance under domestication. For exhibition stock it would be impossible to keep birds in show condition unless well housed. Elaboration in poultry houses is, however, unnecessary and economically a mistake. So far as the fowls themselves are concerned it is rarely accompanied by any commensurate advantages, although the work of attendants may be facilitated. Simplicity

of construction and method are not only economical, but the fowls thrive equally well, are as healthy and productive in plain structures as in more ornate forms.

Upon farms and small holdings, where only a moderate flock of fowls are kept around the homestead, the preferable plan is to use one of the ordinary buildings, taking care that this is well ventilated, light, dry, and clean. When greater numbers are to be maintained under range conditions, the aim must be to distribute these over the land rather than to concentrate round a single building. Mobility is, therefore, an essential. To that end the fowls should be divided into flocks of twenty-five to thirty each and accommodated separately. This means that small houses of a type that can be easily removed from one place to another should be used. From the point of view of capital expenditure this system may appear to be more costly than use of large buildings, proportionately to the total number of fowls. It is not really so, because the houses are not so large and fences are unnecessary. To facilitate removal, wheels or runners may be fitted to the houses, or the structure be built in sections. In that way the poultry-keeper is master of his position. As a field or plot is cleared of crops the birds can be transferred to it. The poultry and the crops will thus form integral parts of the whole scheme of operations, each contributing to success of the other.

PRINCIPLES IN HOUSING

Whatever the form of house built for fowls, there are principles which must be applied. For instance, in a temperate climate poultry do not require any special provision to keep them warm in order to be healthy. The protection provided naturally in the shape of feathers is amply sufficient to defend the body against

changes of temperature. This does not mean, however, that the fowls should be exposed to driving wind or rain.

Observations made some years ago at the South-Eastern Agricultural College, Wye, revealed that in order to maintain poultry in good health at least 10 cubic feet of space, combined with efficient circulation of fresh air, should be allowed for each bird. Where a scratching-shed is combined with the roosting place the space should be doubled, and a capacity of 20 cubic feet be the minimum allowance. On the former basis—that is, for portable houses—these may be constructed 8 ft. long by 6 ft. wide and 6 ft. to the eaves. If span-roofed, each would, apart from the roof space, contain 288 cubic feet and provide for 25 to 30 fowls. What should be kept in view is that the larger the number of inmates, the greater proportionally must be the cubic air space.

Wood is the material generally used for poultry houses other than permanent buildings. For such as have to be moved, occasionally or frequently, it is indispensable, as weight is an important consideration. In the former case ¾ in. to 1 in. deals are most suitable; but in sectional houses 1 in. boards are to be preferred. Houses on wheels require a much stouter frame than those in sections or fixed. In that case quarterings should not be less than 2 in. square, and 2½ in. by 2 in. will be better. The timber should be good and well seasoned, otherwise repairs will be frequently required. The roof should be substantial, either with tarred felting over the boards or corrugated iron. For portable houses the last named adds considerably to the weight. Under no circumstances should corrugated iron sheets be used without a lining of boards.

The most important consideration is that there shall be a constant and abundant supply

of fresh air. In no branch of poultry management has greater advance been made within recent years than in respect to effective ventilation of poultry houses, though many of the older forms still remain. In these the attempts at ventilation are usually inadequate, such as spaces under the eaves, or holes or louvre boards in the ends. They do not ensure a sufficient circulation of air.

A sign of inadequate ventilation is condensation of moisture upon the walls. At all times this is bad for the fowls, and in winter it may be serious, leading to chills, and to frozen combs when the temperature is low. These are not, as was formerly thought to be the case, due to low temperature alone, but to low temperature combined with moisture. Introduction of what is known as the open-fronted house, referred to below, has completely changed the conditions, and ensures that the house can be both well ventilated and well lighted.

In permanent erections cement should be laid down for floor as a protection against rats and damp. A floor of this description must be kept covered by dry earth or road sweepings, with litter above. Earth or sand or gravel well beaten down may also be used in place of cement if occasionally renewed. For movable houses on wheels or runners, solid wooden floors, which should be littered to prevent manurial action upon the wood, are better, as these protect the fowls against enemies and draughts; but in the case of colony houses, which are not intended to be frequently moved, the ground upon which these stand may form the floor.

FITTINGS

The fittings inside a house should be as simple as possible, and all that is required are perches and nests. The former should be placed parallel with the back wall, and consist of 2 in. by 1½ in.

scantling rounded off at the corners, resting upon supports, thus raising them about 2 ft. above the ground. The perches should be all upon the same level, 18 in. to 21 in. apart, and made so that they can be easily removed for cleaning.

Fixed nests should never be used, owing to the difficulty of keeping them clean and free from parasites, which thus frequently find a harbourage. For small flocks single nest-boxes without bottoms are to be commended. Where numbers are greater, allowing one box for each three hens, an excellent arrangement is to build these in one or two rows of four or more, the lower tier on a shelf raised a foot above the ground, and the flat top of this tier forming the bottom of the upper. In that case the higher row should have a sharply sloping cover to prevent birds perching on top. As each row is lifted all the contents drop out. By lime-washing the boxes regularly and replacement of the nesting material, straw or hay or chaff, there should be little trouble. In portable houses a row of nests is often fixed on the outside, with access for fowls from inside. The eggs are collected from the boxes by opening a sloping lid. That is a satisfactory arrangement provided the bottom board is hinged, so that when unfastened cleaning is facilitated.

THE GOSPEL OF CLEANLINESS

Dr. Morse, of the U.S. Bureau of Agriculture, has laid down a series of maxims for poultry-keepers, which should be observed by all. These are :—

1.—Clean out the birds by the means of Epsom Salts, administered in an evening meal, estimating one-third of a teaspoonful to each adult bird.

2.—Clean up by spreading powdered slaked lime over runs and floors of houses.

3.—Clean water supply, to be obtained by adding permanganate of potash, enough to give it a claret-red colour.

4.—Clean food, to be secured by application of heat, if perchance contamination has occurred.

5.—Clean eggs by dipping them in 90 per cent alcohol just prior to incubation.

6.—Clean incubators and brooders by thoroughly scrubbing with boiling water and good old-fashioned kitchen soap.

7.—Clean breeding—that is, breeding from the most vigorous stock consistent with the requirements of good breeding.

To the above may be added that where hens are used for hatching, nests and coops, food and water vessels, must be kept clean all the time, free from parasitic life, to give the mother a fair chance; also that when the chicks, whatever these may be, are hatched they should be given fresh, clean soil. Trouble of any kind arises from neglect somewhere and somehow, generally by ignoring the principles of breeding and sanitation.

OPEN-FRONTED HOUSES

In no direction has a greater advance been made than by use of what are known as open-fronted houses. These involve a complete reversal of the old idea that by conservation of heat egg-production is increased, which idea was formerly prevalent. It was generally thought that by restricted quarters and a comparatively small air capacity the birds were protected against cold and exposure and, as a consequence, were thought to lay better. To some extent, and for a short time, such a result may take place. It means, however, that the vitality of the birds is reduced and, as a consequence, a great amount of disease is caused.

The reason is that under such conditions there is a totally insufficient supply of fresh air, and during the hours when the birds are at roost they are deprived of what is one of the most important natural elements—namely, oxygen, which can only be obtained from the atmosphere. Many devices were adopted to overcome this condition and to give the birds plenty of fresh air. It is not too much to say, however, that in the main they totally failed.

There is very little need to attempt to describe an open-fronted house. It is simplicity itself. Whatever the material of which it is built, the three walls and the roof must be substantial and, as far as possible, air-tight. The other side, preferably that to the south, should be open except that it is covered with wire-netting. In order to prevent rain driving inside there is generally some shutter arrangement in front to carry off the water and to keep the inside dry. Moreover, it is always better for the front to be pretty high, so that the sun may find access right to the back.

When this form of house was first introduced in America muslin screens were used to offer a measure of protection, but these are not required in the United Kingdom. From experience, it is found that birds are healthier kept under these conditions, and if properly fed they lay better even in winter, and also when eggs have to be used for hatching the results are more satisfactory and the chickens much hardier. Even with portable houses similar methods should be adopted.

SCRATCHING SHED HOUSES

Nearly all modern poultry houses of a larger size are now built on what is known as the Scratching Shed principle. The objects are twofold—first, that the birds may have shelter in unfavourable weather and, if necessary, be

kept entirely under cover; and, second, that they may be induced to take abundant exercise, as food is supplied in litter and has to be worked for by scratching. The last-named influence is most important. Fowls on range—that is, at liberty—do not require any such provision so far as exercise is concerned, for, if not overfed, they will be busily engaged all day long seeking for food and thus maintain their organs in activity. When kept under restricted conditions the tendency is towards a lethargic habit of the body, as a consequence of which, especially when feeding is abundant, fatty deposits accumulate on the muscles and organs, which tend to reduction of productiveness and often lead to liver and digestive troubles. Introduction of this system has undoubtedly made possible a great increase of poultry-keeping. Briefly stated, intensification would be practically impossible except for this method.

Scratching sheds are of many forms, but agree in essential details. One of the earlier types consisted of a building of which each section was 18 ft. long by 10 ft. deep, the front 7 ft. 6 in. high, sloping to 5 ft. at the back, thus obtaining all the sunshine possible. It included a roosting and laying compartment 8 ft. by 10 ft., and a scratching shed 10 ft. square, the partition and door solid, except that the upper part of the former was netted. The front of the roosting compartment was solid except for the window, which was made to open, and that of the scratching shed section wire-netted. Experience has shown that in the United Kingdom for the number of inmates, twenty-five, the size was greater than was necessary. It was, however, built on American lines. In that country, where the winters are more severe than is the case with us, frequently it is necessary to keep the fowls entirely under cover for several weeks together, in which case a greater

amount of shelter is warranted. There, as a protection against snowdrifts, the plan in many instances is adopted of having a frame upon which is stretched fine glazed muslin to fit behind the netting. When not in use it is hung up against the roof so as to be out of the way. In this country such arrangement is needless. Outside is, first, an enclosed gravel run to each section, 20 ft. by 18 ft. wide, in which the birds spend most of their time ; and, second, a single grass run for the two lots, 100 ft. by 36 ft. wide, that is, the width of two sections, the inmates of each using it alternately. The great advantage of the gravel run was that as the bulk of the manure fell there or inside the house it could be removed in the former by daily sweeping, the labour of which was more than compensated by the manure thus gathered.

A very useful form of a semi-intensive house of this class is 45 ft. long by 14 ft. deep, 9 ft. high in front and 6 ft. at the back. The front has in many cases a row of large windows with netting above, but it would be better if the space were netted entirely. This house will accommodate 150 hens, allowing rather more than 4 ft. of floor space and nearly 30 cubic feet for each, as more than two-thirds of the floor is used for scratching.

Larger houses holding as many as 400 layers are also valuable for the purpose. These may be built 100 ft. long by 16 ft. deep, so as to allow 4 sq. ft. for floor space for each inmate, as already stated. In all buildings of this and the former type half-partitions should be provided at, say, intervals of 20 ft., from the back forwards, as these prevent draughts sweeping through the house, especially when the birds are roosting. The frontal portion is entirely open over the whole length. Many operators prefer that the roosts shall be transverse, and therefore short, instead of running horizontally

with the back wall, as in that way a freer supply of air to the birds is secured. Big houses of this type must have double yards, to be occupied alternately and planted when not in use by the fowls.

EFFECT OF LIGHT ON LAYING HENS

What would appear to be a momentous discovery is that by use of artificial light for lengthening the days of hens winter egg-production can be greatly increased. This is not so much an increase in the annual total of eggs laid by the individual hen as a transference from one season to another, and, consequently, a much higher money return for practically the same number of eggs. Such system was introduced in America, due to an accident. So remarkable are the results that the writer has found during two recent visits to that country it is being extensively adopted both in the Atlantic and Pacific States. In many instances it is found, and in areas where winter conditions are very severe, that the winter production is increased three and fourfold, and a corresponding reduction in the time of lower values—that is, during the spring months. It is capable of adoption by all who use one of the larger houses already described, though there seems no reason why such should not be the case in houses of more modest size. Experiments in this country have given equal results with those obtained in America.

Observations have shown that during the period of longest nights hens securing their last feed at, say, 5 p.m., are unable to eat more food than will be digested by midnight. As a consequence they have to go several hours before a further supply is obtainable, and thus have not enough material for forming eggs, without which it is impossible to be productive. It is suggested that the reason why they lay better

during the longer days is here explained, much more than as a result of higher temperature. Should such be proved by further experience, though the system has been in limited operation for several years, it cannot fail to revolutionise the poultry industry.

The plan as adopted is from October to March to illuminate the house in which the layers are enclosed—say, a scratching shed with abundance of floor space for litter feeding—from dusk to 8 p.m., and turn on the light again about 5 or 5.30 next morning, so that the time of roosting when no food is obtainable is about nine hours out of the twenty-four. This is accomplished by using in the houses oil lamps, gas jets, or electric bulbs suspended from the roof, thus lighting the floor to the same extent as would be the case during an ordinary day. For each hundred hens 50-candle power illumination is sufficient. The advantage of electric light is that it can be made to act automatically both for turning out at 8 p.m. and turning on in the morning. Except for the greater amount of labour involved, the other illuminants are equally effective. As a matter of course, more feed is consumed by the birds. That, however, is compensated by a greater production during the winter season of the year.

One record out of many that could be cited, records that a flock of hens to which lights were applied on December 13th were at that time only laying 8 eggs per hundred birds. After twenty-three days, spite of severe winter conditions, with light they were producing 83 eggs per hundred birds per diem. At the same time another flock without light fell from 40 eggs per hundred birds to 20 per day. It is small wonder, therefore, that the system is extending rapidly, especially as the cost is very small, with flocks of a hundred and upwards not exceeding ½d. per bird per month. Experience has shown

that birds intended to be used as breeding stock should not be so treated.

OUTSIDE CONDITIONS

References have been made above to the importance of keeping the ground surrounding poultry-houses free from contamination by manure. One great advantage of the distributive and colony systems is that with these, by removal of the birds from one location to another, ordinary cultivation prevents all dangers in the direction indicated. Where kept more or less permanently on the same ground under semi-intensive methods, by the provision of double runs alternately occupied, whether in grass or arable, an effort is made to exhaust manurial elements by a regular system of cropping. With use of scratching sheds a large portion of the manure produced falls within the house. Therefore the risks of soil contamination are minimised. Whether in this way accumulation of manure in the soil can be prevented has yet to be proved. Many failures have arisen as a result of neglect in this direction. Cultivation must be as intensive as is the poultry-keeping. Hence it is that larger numbers of birds can be maintained on arable as compared with grass land, because growth of plants is much greater. Fruit trees help in this way, but more slowly, and thus the stock must be fewer per acre. In smaller runs it is practically impossible to thickly and continuously occupy the same land, which must either be entirely vacated by the fowls and well cultivated or, in the case of very small plots, be replaced by fresh soil. As indicated already, under a rotation system each plot should be occupied by the birds not more than one year out of four. Effective sanitation and hygienic conditions are as necessary for poultry as for human beings.

USE OF FOWL MANURE

Upon farms where fowls are at liberty the manure produced is utilised to the fullest extent, at any rate, such as is voided during the day. In this way what is one of the most valuable by-products of poultry-keeping is turned to account. It must be remembered that the high percentage of nitrogen in poultry manure makes it especially valuable for crops. Observations made some years ago show that of the larger breeds twenty-five fowls will produce a ton of moist manure in twelve months.

Where there is a large amount of waste is in respect to the manure produced at night, and also where the birds are kept in confined runs. Some plan, therefore, should be adopted whereby this can be preserved and the ammonia contents be utilised. If it is left out in the open air a large amount of the virtue will be wasted. There are two ways in which the manure can be treated. Where a large number of poultry are kept it is wise to build either a tank or a shed, which is all the better if made of cement with one side of wood for emptying. There should be placed in this a layer of either dry earth or peat, if the district produces the latter, upon which should be spread an equal thickness, say, six inches, of the manure, and then another layer of the dry earth or peat, so continuing until the place is filled. The effect of this is that the dry earth or peat is impregnated with and retains the manurial contents, and in the course of a few months it becomes a composite mass. Another recommendation is to mix, say, 30 lb. of hen manure, 10 lb. of sawdust, 16 lb. of acid phosphate, and 8 lb. of kainit. The treated mixture should be applied to the land shortly before turning, or if it is used upon grass it should be lightly spread. The value of manure is at least 2s. per hen per annum.

ASPECT

In all climates the question of position is important, both in relation to extremes either of summer or winter, against which protection is requisite. Throughout the British Isles severe winter conditions are seldom experienced, and it is infrequent that there is very high temperature in summer. Arrangements, therefore, can safely be made to take full advantage of all the sunshine there may be. It is needless to say that damp land is always harmful and should be avoided, not only from the effects of moisture, but that it makes the land cold. An ideal position is the southern slope of a hill or undulation, for that means natural drainage, and the sun's rays are able to exert full influence upon the soil. These remarks apply to fixed houses. Under the distributive system changes may be made in accordance with the season of the year, taking advantage of whatever shelter there may be. Birds at liberty adapt themselves to the seasons. It is where there is restriction that precautions are necessary.

CAPITAL EXPENDITURE

It is impossible except at very great length to deal with the question of capital outlay on plant and birds, which vary very greatly. It is enough to state (1) that much money can be laid out which will never earn a profit in that it is superfluous and therefore non-economic. Amateurs who desire to have an ornamental plant should debit whatever is not necessary to the fowls to themselves and not to the poultry account; (2) that good materials and stock ultimately are most profitable, from the fact that with the former repairs and renewals are much less than if the structures are inferior; (3) that in calculations upon which operations are based 10 per cent of the total cost should

annually be debited for depreciation and as much allowed for repairs and renewals ; (4) that among utility stock two years may be regarded as the average duration of life ; therefore the cost of replacements, less selling values of the older birds to be got rid of, has to be provided for. This means, either by breeding or purchase, half the stock has to be replaced annually ; and (5) that interest upon cost of equipment and stock should be charged in the yearly balance-sheet.

Section IV

MANAGEMENT OF THE POULTRY

Poultry when living under natural conditions can not only change their environment, but instinctively adapt themselves to the varying circumstances. Under domestication they are denied the opportunity of individually or collectively determining what is of the utmost importance. Much loss arises as a result, owing to the fact that what is primary in its influence is relegated to a subordinate position, and that essential factors for the maintenance of health are frequently disregarded. The more intensive is domestication so do the risks increase, equally as to numbers and methods. Only one example need be given—namely, as to contamination of soil by manurial action. Under a natural environment, equally as to the number of poultry to the area and that the birds are free to change from one place to another, the manure produced is easily and rapidly assimilated by plant growth. With a vast relative increase of poultry population under domestication, especially where fowls are enclosed within runs, that is no longer the case. Special steps

must, therefore, be taken to counteract the influences named. Hence success is largely dependent upon effective and regular control.

RANGE OF CONTROL

Reference has already been made as to the importance of cleanliness in poultry houses and general conditions. That is a prime necessity, without which all else will fail in its purpose. Control, however, involves much more than provision of hygienic conditions. In it are involved breeding in its many ramifications, provision of a suitable and favourable environment, dealt with above. Additional are a multitude of other factors, such as time and methods of hatching and rearing, feeding, etc., together with diurnal attention to meet those requirements, the absence of which will assuredly mean failure. By reason of intensification, however applied, the calls upon the poultry-keeper are greater than with any other class of live stock. The pursuit demands regularity in respect to details, making it complex in the extreme, varying in accordance with the method adopted. Where poultry are given free range control is at the minimum. Even in that case ultimate success depends upon many factors for which the fowls have no responsibility, as these are under control of their attendants. Where the environment is restricted, the need for such care is correspondingly increased.

PRE-NATAL INFLUENCES

The egg from which emerges a chicken is one of the great mysteries of nature. We cannot discern, even by aid of a powerful microscope, what are the differences between one egg and another so far as size, racial characters, colouration of plumage, and productivity of the potential chicken are concerned. Yet these are present, otherwise all breeding would be nothing

more than chance. Within an egg are concentrated the accumulation of forces from ancestors immediate and more remote, some of which appear to be more or less dormant, whilst others are much more powerful. Such may be termed racial or breed factors. In addition are others to a much larger extent dependent upon the parents for one or more generations. In these are chiefly involved constitutional vigour. Not only must an egg contain the breed characters and qualities, which appear to be contained in the germ vesicle, but also a supply of materials of the nature, in sufficient quantity and with the maximum of elements necessary for construction of a chicken with the quality of liveability. Upon this aspect of the question very little is known. An animal is carried within the mother's body during the embryonic period, during which it is able to draw whatever it requires for growth and development. Save oxygen, an egg must provide everything. For that reason not only is it necessary that the male element shall fertilise the female germ, which is his sole purpose, but that the hen shall form yolks and abundance of albumen from which the body of the chick can be constructed. Limited though knowledge is upon this important subject, experience has abundantly proved that whatever weakens the bodily powers or functional activities of the parents is antagonistic to vigour in the chickens hatched by or from them. To breed from hardy, vigorous stock is a prime necessity, and also that these shall be able to obtain the elements without which chickens cannot develop and grow during the hatching and post-hatching periods. More is said as to this question below.

EGGS FOR HATCHING

A great amount of loss accrues from the fact that many people do not carefully regard the

egg which is selected for hatching. Apart from the question of age of hen producing the egg, and whether she has been selected by reason of her proved qualities, there are other points to take into account. For instance, it is not enough to simply use any eggs for this purpose. Selection is as important at this stage as any other. It is by no means an uncommon practice for people to put down eggs as laid without any choice, and as a consequence they are making for reduction of the value. The statement is frequently made in support of such method that the size of the egg, for instance, has nothing to do with the size of the future chicken. That is undoubtedly true. For instance, a Campine, which, when fully grown, does not weigh much more than 3½ lb. to 4 lb., produces large eggs; whereas a Wyandotte, which will be, at least when matured, twice the weight of the Campine, lays an egg which is from 10 to 15 per cent less in size and weight. The point, however, which has to be taken into account is that in a large number of our breeds the size of egg is not natural. It has been brought about as a result of selection. If such increase is to be maintained, then it is necessary to take steps required in that direction. Therefore one of the first points to be considered is the size of the egg. This does not suggest there is no limitation in weight, because it would be unwise to use for hatching purposes eggs that are abnormally above the average of the race. At the same time, where there is any tendency to a size smaller than market requirements, the egg chosen for hatching should always be of good size—if anything, over the average. Selection continued through a series of years will gradually make for increase of size, from the fact that we use eggs from hens which naturally lay those of a good weight. A further point to be noted is that the shell should be even, and if spherical

in shape it is the more desirable. We all know the shape of an egg. Another thing is that the shell should be strong without being unduly thick. Anything in the way of weak or malformed shells should be rejected. There is also the question as to the age of the eggs. Whilst it is perfectly true that eggs may be held for some time, it is undesirable that they should be kept a day longer than is absolutely required, because every day after an egg is laid it loses something of the original virtue.

The above remarks apply mainly to the production of market eggs, because values are thus determined. For domestic purposes size and shape of shell are of lesser importance, though even with these it is always wise to maintain the racial standard. Exhibitors, however, operate on totally different lines. At the same time, with these selection of eggs is requisite.

HENS OR MACHINES FOR HATCHING

Essential though incubators now are—and without these the poultry industry would not have developed to the extent now seen or the output be maintained on its present basis—it is undoubtedly the case that artificial methods are second best, as that hens, whether as sitters or mothers, usually give a better percentage in hatching and more vigorous chickens than are obtained from incubators. There are influences which a hen exerts that have never yet been discovered, and it is improbable, even though improvements may yet be made of artificial methods, that in these respects the latter will ever be able to fully rival the former. The great increase of embryonic and post-hatching mortality which has been so manifest during recent years, more especially in connection with commercial poultry farms, may be to some extent due to adoption of artificial methods and to some failure of essential influences. At the

same time, the other factors named above are to some extent responsible. A few large breeders have reverted entirely to natural hatching even where they rear in brooders. Exhibitors and smaller poultry-keepers generally will find it preferable to use hens in both directions unless they keep a non-sitting breed, in which case incubators are almost a necessity.

SITTING HENS

Where the hen fails is in not always being available. At some seasons there are too many broody hens. When so used they must have a fair opportunity for accomplishment of the task committed to them, which is equally true with regard to the eggs placed under their charge. In addition to the heat applied by the hen, an indispensable factor is abundance of fresh air in order to supply oxygen to the embryos. A hen that steals her nest seldom fails to bring forth a chicken out of every egg.

The plan which has been abundantly proved in practice, where a number of hens are so engaged at the same time, is to use a spacious outbuilding or poultry house for the sitters, in which are as many boxes as occupants. These should be about 20 in. square and high, without bottoms, and stand upon a bed of fresh earth. A loosely fitting door in front or a lid, and plenty of ventilation holes on each side near the top and bottom, complete the box. The nest is made inside, and is better if of fresh earth, covered with a thin sprinkling of straw. A dozen or more of such boxes can be accommodated in a house 8 ft. square.

Feeding is the great point. A preferable plan is to have outside a run, covered for preference, in which is placed food, fresh water, and a good dust bath. The hens should be removed from the nests once every day, say, three to six at a time, and placed in this run for a period which

may extend to half an hour, leaving the nests open so that they may cool and draw in a supply of fresh air. At the expiry of the time named each hen should be returned to her own nest. Sometimes separate feeding-cages are used to prevent any mistake being made. The above is a simple method ensuring perfect control.

INCUBATOR MANAGEMENT

Considering the artificiality of this system, it is remarkable how great is the success with which incubators are operated. That is especially true where eggs for hatching are obtained from stock birds on range, as these possess a vigour not found in birds which are kept intensively. At the same time, machines have their limitations, not possessing a hen's instinct. They require suitable conditions, efficient management, and eggs strong in capacity for producing live, vigorous, healthy birds, whether chickens or ducklings. Without this combination the best machine will fail, however skilfully it may be operated.

So far as conditions are concerned, the main requirements are an abundant supply of fresh air, in order to provide the necessary oxygen to lamps and eggs, no overcrowding, absolute cleanliness, and absence of sunlight. There must be free ventilation below, around, and above the machines, and plenty of pure air. A great mistake is made in completely filling incubator drawers with eggs. Better results are generally obtained if not quite full. Nor should there be too many machines in one place. Two cubic feet of air space should be allowed in the room for every egg in the machines. Thus in a room 10 ft. square and 8 ft. high not more than 400 eggs should be in machines at the same time.

Efficient management means regular and judicious attention to all details, whether that

be trimming and refilling lamps, turning and cooling the eggs, supplying water to trays, etc.

Where only a single incubator is operated the question of its position should be easily determined, whether that be in a cool, sweet, well-ventilated cellar or a building above ground. In North America, east of the Rocky Mountains, it has been customary to use incubator cellars, more especially for early hatching, so as to minimise the effect of low atmospheric temperature. That has never been found necessary in the United Kingdom. What we have to guard against is high temperature during the daytime, with sudden drop when the sun goes down. Therefore a building should be used in which the windows are north and north-east, and so substantial as not to be affected by the midday sunshine, or be shaded by other buildings or trees. Ventilation should be secured by inlet shafts below the level of the machines.

TYPES OF INCUBATORS

For ordinary purposes machines with capacity of from 100 to 300 eggs are most generally employed. Both smaller and larger are made. As suggested above, those whose operations are on a very small scale will, except as a question of interest, be well advised to depend upon hens as sitters and mothers. There have hitherto been two leading principles as applied to incubators—first, that known as the tank machine, of which the Hearson is the leading and original make, in which the upper part of the egg chamber consists of a copper tank: heat from this radiates upon the eggs, which are supplied with fresh and moist air entering from below; and, second, that known as the hot-air machine, for which it was claimed that air heated by a amp at one side was diffused equally over all he eggs and passed out below. With both a

considerable measure of success has been attained. We have always found that the tank incubator was most efficient and reliable, and it is of interest to note that in America, where the hot-air type was formerly universal, this is being rapidly displaced in favour of tanks. In that country electrically heated apparatus are being largely adopted, and with a large degree of success.

As a result of rapid increase of commercial egg farms and of central hatcheries, a demand for larger machines has become very insistent. Their introduction has simplified the labour very greatly. To operate a plant having an egg capacity of, say, 50,000 eggs at one time with, say, 400-egg machines would require 125 of these and as many lamps to trim and fill every day. There are many hatcheries with egg capacity of 100,000, some 200,000 and more, and one of a million in the State of Ohio, U.S.A. The first stage of evolution was a duplication of machines all heated from one stove, with which exception they were individual. Other forms are now being introduced. These mammoth incubators, as they are called, are, *pro rata*, much cheaper and more easily operated than a large number of smaller machines.

DEATH IN SHELL

This is the term applied in the case of fertile eggs wherein the germ or chicken dies during the hatching period—that is, prior to emergence from the shell. Where natural methods are adopted the number lost in this way is comparatively small, though by no means unknown, and variable in degree. Embryonic mortality is the greatest difficulty which has followed the use of incubators in this and other countries, more especially where operations are on a large scale and extend beyond the regular and natural season of hatching. In some instances the

average mortality varies from 30 to 75 per cent of fertile eggs. A non-vitalised egg has not the possibility of producing a chicken, whereas a fertile egg has. When the latter fails to accomplish this purpose, especially to the degree stated, it is an indication that something is wrong. It is our business to discover the cause. Unless we can do so, the losses referred to will continue and disaster must follow.

The cause of death in shell and chick mortality may be in the incubator or its management. Evidence, however, would indicate that these account for a small proportion of dying embryos, and that we have to look to other influences. From such knowledge as is forthcoming, the loss is greater in travelled eggs than those incubated where they are laid ; that eggs from highly or closely bred stock, from hens which have been forced as layers, from birds which are kept in large numbers within limited houses and runs, and from young pullets, are much more liable to death in shell than are others. It therefore appears largely to be a question of reduced vitality in the parents, who pass a degree of weakness to the eggs.

HATCHERIES

A later development equally in this country and America is the establishment of central hatcheries where chickens are brought out and sent away to purchasers when a day old. Some of these establishments are on a very large scale. They afford great opportunities for exercise of skill, serving a valuable purpose in that farmers and others can obtain a supply of fresh stock without any necessity for keeping breeders. For householders they are the main source of supply. Chickens at the age stated will travel hundreds of miles and apparently be unaffected by the journey, provided that they are properly packed. When a week old the losses are much

greater. For attainment of satisfactory results everything is dependent upon adequate supply to hatcheries of fertile eggs containing hardy, vigorous germs. For reasons already given, highly bred stock, and especially those kept in small enclosures, are unsuitable. In all cases freedom of range is essential for the birds from which eggs to be so used are obtained. If that be secured, the system is capable of great extension. The main point, however, is that the buyer of day-old chicks has no control over the breeding stock.

A further cause of serious loss is found in mortality among young chickens during the first two to four weeks after emergence from the shell. With these there is enough vigour to enable them to hatch. They have not, however, the quality of liveability. It would appear that, even though bad management and feeding may be responsible in some measure, the same influences are at work. No one who is engaged in the business on a commercial basis can ignore fundamental questions like these, which not only involve a much higher cost in production, as losses have to be paid for, but at times have threatened the poultry industry.

TESTING EGGS

As a question of economy eggs undergoing the process of hatching, whether by hens or incubators, should be tested so as to discern whether any are what is called infertile—that is, have not been impregnated by the male element. Such eggs as are clear can be removed at a time when they are still valuable for cooking, even though not in new-laid condition. Generally the sixth or seventh days are suitable for this test to be made, in that there is no danger of making a mistake. Lamps for testing are usually employed, or if in a sheet of millboard an oval aperture is cut rather smaller

than the egg to be tested, by holding this in a darkened room before a lamp or electric bulb, with an egg fitting the perforation, between the light and the eye, the contents will be clearly revealed. If opaque, with darkened regions are seen, it is fertile; if clear, even though cloudy, it is infertile and should be removed. In this way the fertile eggs have greater chances of successful hatching.

PERIODS OF HATCHING

In domestic poultry the periods of hatching are as follows: Bantams, about 19 days; fowls, 21 days; ducks, 28 days; geese, 30 days; turkeys, 28 days. Freshness in the egg usually means that hatching takes place a few hours in anticipation of the times stated. If they are older, the hatching may be somewhat delayed. Should an incubator be worked at a higher temperature than provided in the regulations, hatching will be expedited. That, however, is undesirable.

WHEN TO HATCH

The natural period of hatching in the northern hemispheres is from February to June, varying in accordance with the latitude and location. As a general rule, for production of breeding and ordinary stock it is wiser to select the months of March, April, and May, for by so doing chickens will have attained early maturity by October and November prior to the advent of winter. Exhibitors usually hatch some of their birds in January, so that chickens may be ready for the summer shows, or be well matured by the autumn fixtures. Those who are engaged in rearing chickens and ducklings for market commence hatching in November or December to supply the spring trade, and autumn hatching is adopted for similar reasons. Egg farmers prefer to hatch from heavier breeds in February

and March, and from lighter and quicker-growing breeds from March to early May, as in both cases, if growth is normal, pullets should come into profit about October and November. As conditions differ, the time of hatching can alone be determined by experience.

COOPS AND BROODERS

For rearing naturally coops are usually employed, and can be purchased at reasonable prices from appliance makers, or can be made quite easily. The simpler these are the better, so long as they afford protection to the broods. Such poultry-keepers as are operating upon a very small scale, say, with only one or two lots of chicks, may dispense with a coop, using an empty shed or house for shelter at night. Birds grow stronger when they are given complete freedom.

Artificial rearing by means of brooders or foster-mothers requires a greater degree of control, whether upon a small or large scale. The most satisfactory results are obtained by use of individual machines, holding from twenty to fifty chickens in accordance with the age, and which can be moved about so as to provide fresh ground. Nothing will more speedily taint a piece of ground than a brood of chicks, and to maintain these in health it is desirable that they be given sweet, fresh earth to run over. Where a large number of coops or brooders are employed these should be arranged widely apart, and the same space not be occupied for at least a week or ten days. Where chickens are reared on a very restricted area, and it is impossible to move them in the manner stated, fresh soil or grass sods should be placed in the brooder. Such removal and absolute cleanliness are the chief factors making for success in rearing. There are various types of brooders of the individual class. For extensive plants many systems have

been tried so as to keep larger flocks of chicks, with only a modicum of success. The latest form is known as a coal-stove brooder, by means of which 300 to 500 chicks can be placed in one house. As it is yet in the experimental stage, readers will do well to study current accounts of how far the system is successful.

GROWING THE CHICKENS

Early laying depends upon hatching at the right time. Equally important is it that chickens so hatched shall be properly grown. It is here where much loss arises. Sometimes the greatest possible care is given during the first few weeks, after which methods are adopted that check growth. On the other hand, many breeders make the mistake of thinking that food is everything and depend entirely upon it, thus frequently defeating the end they have in view.

So soon as chickens have passed what may be termed the infantile stage—that is, from six to eight weeks onwards—if they are intended to be used as breeding or laying stock, as much freedom should be given as possible and the birds be encouraged to forage for food to the fullest extent. The consciousness of unlimited range, the absence of any sense of restriction, are great factors with all young life, to which activity is essential for development of and building up a strong body, charged with vigour in every organ and function. The more of this there can be the better. Many are misled by appearances. At first it may seem as if those which are coddled to some degree are growing more rapidly, which may for a time be true. That does not, however, make for strength and final development.

Where a check may be given to growth of chickens is by exposure to unsuitable conditions. Consequently extremes of heat and cold are undesirable. The perfect summer for chicken

raising is when the air is moist and genial, for then natural food is abundant. When the season is dry and hot as much shelter as possible should be given, and softer food is required. If cold, good housing, plus comfortable quarters, enable that to be overcome. The prevalence of cold winds undoubtedly retards growth of plant life and also of animal life ; whereas it is in the warmer days and nights that the greatest advance is made. At the same time, so far as chickens are concerned, they need shelter just as much against heat as cold, which fact is frequently forgotten. Upon farms where hens and their broods are at liberty there is no need to trouble about the matter, because they adapt themselves to their circumstances. Otherwise protection by shade should be given in summer.

POSITION IN REARING CHICKENS

There is always a tendency to ignore the little things which make for success, which is true in connection with the raising of chickens, more especially as to the position of ground devoted to this purpose. Frequently this is chosen more for the convenience of the attendant than for the good of the birds, and it is not surprising that frequently the results are unsatisfactory. The points which have to be kept in view are, first, that the ground shall be fairly dry, well drained, and not be heavy. Cold earth is largely due to dampness, and therefore heavy land, which is more retentive of moisture, always means slower growth, at any rate, during the months of the year when there is a considerable amount of atmospheric moisture. That explains why clay land is colder than gravel or lighter soils, and also there is not the same natural drainage. It is not unfrequently the case that the expenditure of a very little labour in laying down drain-pipes or digging trenches would make all the difference between a good and an

unsatisfactory situation. It will be seen, therefore, that low-lying land which is apt to be waterlogged is not suitable to the raising of chickens. Although the top soil may be apparently dry, if there are many water-courses that is affected and we arrive at the same result. Fortunately, however, in some valleys the ground is largely gravel, and the effect is less seriously felt. A further point is in the position of the ground. For early raising, which in this country applies during the first five months of the year, the ground should be open to the south, so that all the advantage of the sun's rays may be obtained. It is not merely atmospheric warmth that we desire for quick growth, but also ground warmth, which is affected by the direct falling of the sun's rays upon the surface, and by its porosity.

SALE OF EGGS

The demand for eggs is far in excess of the supply, and there is no difficulty in obtaining a market in any part of the country, more especially when these are in first-class condition and new laid, i.e. not more than three to five days old. The general standard of weight is 2 oz., though slightly above is preferred. Under ordinary conditions brown-shelled eggs were in pre-war days most acceptable to consumers in many markets. That is no longer the case owing to insufficiency of supply. A further point is that sterile—that is, non-fertilised—eggs are desirable. Upon farms, holdings, allotments, and gardens a careful examination of the birds should be made, say, on the 1st of June in each year, and every male bird, adult or young, that is not to be retained for future service be got rid of immediately. Their room is better than their company.

There are many reasons for this recommendation, the chief of which are :

That as a question of economy a male bird

not at present or prospectively to be used for breeding is wasting food, does not pay for his keep, and to that extent is a direct loss ;

That hens which are not mated with a male bird are equally prolific with those so accompanied ; and

That infertile or sterile eggs, laid by non-mated hens, are better as food, will deteriorate much less rapidly in hot weather, and will preserve their freshness and quality longer than those which are fertilised. Such fertilisation is alone of value for reproduction of the race.

PRESERVATION OF EGGS

The system of preservation is intended to equalise supplies and to carry from the spring months, when production is at its maximum, whatever surplus there may be to the winter, when the output is at the minimum. Were it not for this process the supply of eggs would be seasonable and few be available from October to January. During pre-war days, especially in surplus-producing districts or countries, a further advantage has been to take eggs off the market when otherwise there would be a glut, thus preventing a slump in prices. Upon the continent of Europe the method of preservation is by use of lime-water, in which the eggs are stored. In America cold storage is generally employed. Water glass, or a solution of silicate of soda, is the simplest and most useful preparation, say 5 per cent of Commercial Water Glass to 95 per cent of water, mixed as directed on the cases in which it is sold. Eggs immersed in this mixture will keep good for cooking over several months if the vessels are stored in a cool place, one not affected by summer heat. The eggs should be quite fresh when placed in the liquid, which must entirely cover them, have strong, unbroken shells, and, if possible, be infertile.

CHICKENS AND POULTRY FOR TABLE

Whatever surplus birds there may be should either be sold to the professional fatters, who make a business of final preparation, or be fed off for two or three weeks prior to killing, so that the proportion of flesh to the total weight of body may be increased. In this way from 1 lb. to 2½ lb. may be added to the body weight in accordance with the size. The birds are better restricted in exercise, either kept in cages or a very small run, and fed two or three times per day upon soft food, consisting of ground oats or fine oatmeal, mixed with soured skim or butter milk. By this system the muscles are softened and the flesh is much improved in quality as well as increased in quantity.

LAYING TRIALS

Within the past few years, thanks primarily to the enterprise and labours of the National Utility Poultry Club, whose example has stimulated others in our own country, British Colonies and other lands, there have been conducted laying trials or competitions, in which selected birds sent by different breeders enter upon a contest for supremacy, to be determined by the number and value of eggs produced by the various pens during a fixed period, now usually twelve months. It is difficult to form any judgment as to the practical value of these contests in respect to the productiveness of the general fowls of the country, but that the tests have had a share in the improvement already made is undoubted. Probably, however, the greater benefit has been educational, direct and indirect. The chief trials are at the Harper Adams Agricultural College, Newport, Salop; Dodnash Priory, Bentley, Suffolk, organised by the Society named above in conjunction with

the Great Eastern Railway Co.; at Burnley, Lancashire, promoted by the Northern Utility Poultry Society; and at Haywards Heath, Sussex, for which the *Daily Express* and the Scientific Poultry Breeders' Association are jointly responsible. In connection with the trials at Bentley the *Daily Mail* has held a very popular contest for small or household poultry-keepers, one which has aroused great interest. These competitions have induced farmers and poultry-keepers to careful selection of stock and to the introduction of more prolific races. Those breeders who have been successful in winning the liberal prizes offered have found, as a consequence, an enormously increased demand for stock.

DISEASE AND ITS CAUSES

The amount of loss to poultry-keepers every year as a result of disease is very great. The subject cannot any longer be treated superficially in that it is too serious, requiring exhaustive consideration. To treat the various forms of disease would demand an entire volume. It is enough to indicate, as far as our knowledge goes, what are the causes of disease in poultry, with such methods of prevention as are understood. We shall ultimately arrive at the stage when, as is already the case in some countries, public research stations will be in operation, at which investigations can be made, whether for individuals or communities, and advice given, the staff engaged consisting of men who are poultry pathologists in the true sense, in that they have specialised upon this branch of live-stock. Up to the present time veterinary surgeons have devoted very little attention to poultry, because it did not pay them to do so. The owner of a horse or a cow can afford to pay an adequate fee for advice if it is sick, which would be in excess of the value of a hen. That

has been the difficulty hitherto. With increase of numbers it is a question of flocks rather than of individual birds.

Many diseases from which fowls suffer are not directly transmitted to their progeny. As examples, chickens hatched from eggs laid by tuberculosis hens in one or other of its forms, even where the lungs are affected, or from liver disease, do not immediately show signs that the parental disease is inherited, and may escape altogether if the conditions and methods of feeding are favourable. At the same time, it is within general knowledge that such progeny are especially prone to suffer from the disease at a later period of life. The consensus of medical opinion is that, whilst the diseases named are not directly inherited, the tendency is present, in that, either by constitutional or organic weakness, there is not the full power of resistance to attacks of bacteria. By that is meant the organ affected in the parents has a lessened degree of vigour in the progeny. On the other hand, we have evidence that bacteria or parasites may be passed by the hen into the egg and thence to the chicken hatched from it, which is thus born to die. That is a further indication of the importance of using only sound stock for breeding purposes. Any class of poultry which reveals indications of organic disease, or which have suffered from a serious affection, should not be used for breeding. Acute diseases which are more rapid in their effects are less dangerous, as these usually end in death or leave the birds so debilitated as to be useless. What have specially to be guarded against are the insidious affections that show few external signs and are much slower in their development. Even with these, however, evidences are generally present that indicate debilitation. The line of safety is to avoid all risks. To seek for stock which are immune to disease is a vain quest. What we

have to do is to prevent disease by favourable conditions and adoption of hygienic methods.

Probably the greater number of affections and diseases, chronic and active, are due to bad environment, even though some of these may apparently arise from other influences. It is impossible to limit the effects of non-hygienic or insanitary conditions which may develop in many different ways.

Want of efficient ventilation deprives the bird for several hours daily of oxygen sufficient for its needs, and by compelling it to breathe air charged with carbonic-acid gas impoverishes the blood, overtaxes the lungs, and, if continued, so weakens the whole system as to render it unable to withstand attacks of diseases, whether chemical or parasitic.

Want of light in the house affords the conditions most favourable to increase of bacteria and parasites which, by preying upon the fowls, gradually reduce their power of resistance. Sunlight is the most powerful germicide known.

Lack of cleanliness has the same effect as that stated above, in addition to which, however, is the action upon the body through the atmosphere, more especially as seen by ammonia from manure.

Dampness, either in the house or the soil, appears to reduce the vitality by more rapid elimination of heat, leading to chills and often causing inflammation of various organs.

Probably that which has been responsible for the greatest amount of disease is tainted soil. Not only does it act like slow poison upon the system, but also the manure offers a medium in which injurious parasites develop rapidly.

When all these conditional influences are found in combination, as is frequently the case, for negligence is seldom in one direction, we have on the one hand reduction of power to combat antagonistic influences, and a great

increase in the enemies and influences to be contended with. Under such circumstances everything is favourable to development of disease.

BACTERIA AND PARASITES

Investigations have shown that nearly all diseases arise from bacterial and parasitical attacks. Under normal conditions the system is able to combat these and throw them off, but if the environment conduces to stimulation of increase of such minute creatures, then there is present the opportunity for development of disease, which will account for many epidemics and outbreaks. Again, it may be stated that in this direction impure water contributes very materially, and for the same reasons. Fowls are frequently kept under such circumstances where it is impossible for them to obtain water free from contamination, and we know how dangerous that is. There are certain forms of disease which seem to be almost entirely associated with tainted water, and among these the most serious we have to combat. It is always interesting to study the development of disease, and additional knowledge in that direction is very important. The first consideration of every poultry-keeper, however, should be to avoid such experience, and the test of his success is that the birds shall be free entirely from troubles of this kind. The loss involved is sometimes very great. The saying that prevention is better than cure is trite, yet embodies a great truth. In the case of outbreaks of disease careful investigation of the conditions should be made, so as to remove contributory causes.

TUBERCULOSIS

The disease most prevalent among poultry kept under restricted conditions is tuberculosis, which is as insidious as in the human subject.

Not until well advanced is its presence known. As a rule, the lungs of fowls are seldom attacked by tubercles, as in human beings when known as consumption, that great white scourge of modern days. The chief organ of fowls to be affected is the liver, which by its soft nature is very susceptible to this disease. That organ when an infected bird is killed is generally enlarged, revealing nodules of yellowish substances varying in size and degree. The kidneys and spleen are also often attacked. When the tubercles attach themselves to the intestines and skin, clusters of cheesy looking nodules are noted. The last named are somewhat slower in their action than where internal organs are affected. Externally the symptoms which point to the presence of tuberculosis in one of its many forms are gradual loss of flesh, giving the appearance of steady enfeeblement, and the comb, face, and wattles become pale in colour. In the later stages loss of appetite and diarrhœa are symptomatic of this disease. So far as known, the causes are ill-ventilated and overcrowded houses, tainted soil, impure water and rich food, the last named especially in warmer districts.

OVARIAN AFFECTIONS

Ovarian troubles are attributable to weakness of the system, which is unable to withstand the strain of high production and greatly increased activity of the egg organs. Forcing pullets to lay early and continuously must impose a strain upon the system unknown in those whose output is later and more limited. That is to be expected, and is met with in every form of animal life. Where any weakening of the system has already taken place it breaks down at a much earlier period than would otherwise be the case. This can be avoided in large measure if care is taken to maintain the vigour of the stock, but

any neglect on that score is certain to be serious. Degeneracy may be attributed to several causes, such as breeding from birds kept under unnatural conditions, to use of pullets for breeding, more especially those which have been abnormal layers, and to rearing in small yards, especially during what may be called the growing periods—that is, when the birds are laying up a store of strength and energy necessary to the accomplishment of their work.

Section V

FEEDING

GROWING THE FEED

The rise in price of foodstuffs during the later war period and after has, owing to greater cost, emphasised the fact that growing food for poultry should, whenever that is possible, be carried out side by side with the keeping of fowls and other poultry. So long as foodstuffs were cheap the question was more or less ignored, although it is true that had the increases of poultry always been associated with production of the food required for them greater success would have been achieved. However, the position of affairs has entirely altered. For instance, poultry-keepers who have to buy all their food for their poultry find to do so that it now costs from twice to three times as much to feed the birds than was the case in, say, 1913, if the same methods and the same class of foods are employed. One of the effects, however, of increased prices is in the direction of compelling greater care in respect to the quantity of food given and also in the class of food supplied. On the other hand,

evidence is forthcoming that upon holdings of every class where the main part of the food required by fowls is produced the increase of cost is comparatively small, not nearly so great as the advance in values. This question is not to farmers of great importance. Poultry-keepers of every class, even those who do not keep more than twenty or thirty birds, will be wise in any developments that are made to include the growing of food for the birds correlative with the poultry operations. If we work out to the legitimate issue this will be found to be the right policy, for two reasons, one of which is reduction in the cost of food, and the other utilising the manure produced by the fowls to the fullest extent, avoiding what is the great bugbear of smaller poultry-keepers, namely, tainted ground. Of course, there is another consideration, namely, where grain is grown, as well as certain forms of plant life, some grains, at least, are not quite up to the standard of market requirements, and would therefore produce a smaller cash return than the better samples. In many cases these inferior grades are actually better for feeding poultry than the finer qualities, and thus, if used for the birds, the cost of feeding is lower than what otherwise would be the case.

GREEN FOOD

One of the chief lessons to poultry-keepers from the war period is that green food can be fed to a much greater degree than was formerly regarded as desirable, and that vigour and productivity can be maintained to the same extent as when concentrated foods form the main diet. Investigations have revealed the fact that in the soft leaves of vegetables are indispensable and economical elements necessary to growth and maintenance of animal life. An abundant supply is, therefore, of importance. Under

certain conditions fowls will be able during the greater part of the year to find sufficient for themselves, but those that are kept in semi-confinement or are entirely without the advantage of a grass run must be provided with this form of food. The nature of green food must necessarily vary in accordance with the various seasons. At all times, however, it should form an indispensable item in the diet. It may consist of rye grass, kale, lucerne, lettuces, cabbage leaves, turnip tops, swedes, turnips, mangold wurzels, or Jerusalem artichokes. In fact, any form of succulent vegetable material may be used. All of the above-mentioned green foods should be fed in a raw state and not be cooked. The only food of a like nature which should be cooked before feeding is potatoes. These should not be fed otherwise. Artichokes not only form a good green food—available during the greater part of the year—but the shade they provide for chickens during the growing stage is acceptable in unprotected or exposed positions.

Among other forms, a very valuable product for fowls is clover hay. If any of that is grown or can be purchased at reasonable rates, it should be stored for use during the period when natural food is scarce, as it is especially useful for laying hens in that it contains the elements required for that purpose. Further, it considerably reduces the cost of feeding when mixed with other foods. The same is true of lucerne hay, which crop is grown not nearly as much in this country as others, where it is found to be a prolific and useful crop for all classes of stock. The only objection which can be urged to the use of hay is the trouble involved, so far as poultry are concerned, as birds cannot eat it dry as can larger stock. Therefore it requires to be cut and steeped, by which means it is brought into condition for mixing with sharps

or meals, and the softening also assists and facilitates digestion. Hitherto we have been too much inclined to what may be termed concentrated foods, those in which there is a small amount of fibre. That has been abundantly proved to be a mistaken system. Bulk is required as well as the more nutritive elements. Fibre has an important function in the process of digestion. We have only to observe what fowls eat if left to themselves in order to discern that fibrous foods enter more largely into their nutrition than is generally thought to be the case. When fresh green food is supplied the fibre is present and in a form easily digested.

GRAIN AND MEAL

Green food should be the basis of all feeding, with other products as supplementary, not the reverse as heretofore. It, however, is not enough where poultry are under domestication, whatever the scope and object, in order to provide materials for greater productivity, and under the more intensive methods to afford an opportunity for securing that exercise which is essential in respect to health and vigour. Exercise of the muscles has a further influence—namely, to ensure complete digestion of food and thus prevent wastage. One important point requires to be emphasised—namely, that whenever natural food, by which is meant whatever is fresh, inclusive of green food and the various seeds and lower forms of life found in the soil, is the basis, the range of supplied foods may be much wider. For example, maize, or Indian corn, is in our climate an ill-balanced food as a staple diet. It may, however, be used freely if in addition to what is recommended above.

For litter feeding in scratching-sheds—that is, where grain is buried among cut chaff—the grains most suitable for this purpose are wheat,

oats, barley, kibbled or broken maize, and dari, varying in accordance with the price at which these can be purchased. With smaller seeds the loss is too great to make their use economical. A further advantage of this system is that the birds are eating all the time, not at stated intervals. Small wheat is often better than the more floury qualities. Oats should be as good as can be obtained, otherwise the amount of husk is disproportionate.

Meals are used for feeding as wet or dry mash, in which way the various pollards, taken from the grain in the making of flour for human food, are utilised. For poultry they are very valuable, giving the bulk required. Among these are middlings, sharps, bran and oat dust. A useful manufactured meal is in the form of ground biscuits, such as Spratt's Poultry Meal, in that it is cooked by baking, and when soaked is easily digested. For chickens it is to be highly recommended.

Meat and fish meal are regarded as important to promote egg-production, in that they contain a high percentage of albuminoids. The mistake generally made is in using such rich foods in excess.

WET MASH

The old notion that by giving soft food hot on winter mornings egg-production is stimulated has been long exploded, as productivity arises from other factors, such as exercise. Wet mash undoubtedly has a beneficial influence in providing food containing a large amount of moisture and in succulent form. Its chief merit, however, is that by the process of steeping or cooking there are many products, such as the stems of vegetables, potatoes, etc., which are thus prepared and can be eaten by fowls. Also that others, in themselves too rich, such as household scraps, are mixed with ingredients

to make a more balanced ration. In that way wet mash is very economical. Whether fed morning or evening does not appear to be of any moment. Moreover, when food is fed in this form once or twice per diem, it should be supplied in troughs so that any remaining may be removed. It should never be allowed to stand, not only that it would become sour, but might be trodden under foot and contaminated.

DRY MASH

Some years ago a system was introduced from America, where labour has been much more expensive than in this country, and every effort must be put forth to save work as far as possible, for feeding fowls by means of hoppers, in which a week's supply of food can be placed at one time, the birds helping themselves as they desire. That, however, is found to be undesirable, as the dry mash should be supplied daily or on alternate days. Birds are content to consume meal in this form. Such mixtures may consist of Indian meal, ground oats, a little meat, and about a third of the total bulk consisting of bran or coarse thirds. A box is made, narrowed at the bottom with a tray below, into which the food falls from the hopper above as that in the tray is consumed by the birds. The fowls help themselves, and, so long as they have a plentiful supply of water, thrive upon it. The great point in favour of this system is that it evidently makes beneficial demands upon the digestive organs, which soft food does not, and as a result, where the latter is used, there is a greater tendency to the development of internal fat. A suggestion is to the effect that the value of dry mash is that it utilises secretions necessary for effective digestion which are mixed with the food in the body. If the food is wet—that is, mixed with liquid—then there is not the same need for these secretions, at any rate, in the

case of birds. This is a point which deserves further investigation and is most interesting. We must remember that in the way of exercising the muscles of the body and giving play to the natural forces which affect the proper assimilation and digestion of the food supplied to them, functional activities must be more or less in conformity with what would be the case if in a natural state. The dry mash system is perhaps a little more costly than when supplied wet. There are, however, certain classes of food which are too hard to be eaten in the ordinary way, but which can be prepared by cooking or softening and supplied in that condition to the birds. Dry mash is generally used for birds in confinement. When to be provided there must be an abundant supply of fresh water.

FOOD TABLES

Appended are specimen diets, all of which have proved of value. Others can be determined upon by the poultry-keeper with aid of a table of analysis and knowledge of the local market value of various ingredients.

For Birds at Liberty

WINTER

Wet Mash.

Maize meal	3 parts
Pea meal	1 part
Barley meal	1 ,,
Bran (wheat)	1 ,,
Potatoes (cooked)	3 parts
Meat (granulated or meal)	½ part

(Mixed with water and made crumbly moist.)

Hard Food.

Wheat	1 part
Barley	1 ,,
Maize	½ ,,

SUMMER

Wet Mash.

Barley meal	2 parts
Middlings	1 part
Bran	1 ,,

(Mixed as stated above.)

Hard Food.

Wheat	2 parts
Oats	2 ,,
Dari	1 part

For Semi-Confinement

WINTER

Wet Mash.

Maize meal	2 parts
Bean meal	1 part
Barley meal	2 parts
Bran (wheat)	1 part
Potatoes (cooked)	2 parts
Meat (granulated or meal)	$\frac{3}{8}$,,

(Mixed as stated above.)

Dry Mash.

Maize meal	3 parts
Bean meal	1 part
Barley meal	3 parts
Bran (wheat)	2 ,,
Clover meal	1 part
Meat (granulated or meal)	$\frac{1}{3}$,,

(Mixed and placed in a hopper.)

The meat (granulated) may be fed in a separate hopper.

Hard Food.

Wheat	1 part
Barley	1 ,,

SUMMER

Wet Mash.

Barley meal	1 part
Middlings	2 parts
Bran (wheat)	1 part
Meat (granulated or meal)	¼ ,,

(Mixed as stated above.)

Dry Mash.

Same as above less 1 part of maize meal.

Hard Food.

Wheat	1 part
Oats	1 ,,

USING SCRAPS

In addition to what has been recommended previously there is a great deal of waste in connection with households by throwing away scraps that would help to maintain a number of fowls. To use these may involve trouble. At the same time a great saving in cost is effected. If a stewpan is kept into which all kitchen and table scraps are thrown, it will only be necessary to add a little meal for drying off to provide an excellent supply of food for the birds. There are many places, such as very large houses, public institutions, hotels, etc., where a supply of scraps can be obtained at a nominal charge. The difficulty, however, with many of these is that the quantity is too great for smaller poultry-keepers, and that before it is possible to use them they have gone bad.

LIQUIDS

The virtues of butter milk for human beings are recognised. Unfortunately a large proportion of our population are not in the position where they are able to obtain that valuable

product. Upon farms, at some private houses, however, this is frequently available. An American writer, who is a large poultry-keeper, declares that by giving soured skim milk or butter milk to his chickens he has entirely stopped what is known as white diarrhœa. The last named is generally admitted to arise from the presence of bacteria in the intestines, and which, when the young birds are fed in the ordinary manner, multiply enormously, setting up an irritation which is fatal to them. The virtue of either skim milk or butter milk is that the acid contained therein appears to kill bacteria, and, as a consequence, the disease referred to is prevented. Poultry-keepers should use such products when available, as in many instances they are largely wasted. Sweet milk has not the same beneficial influence, because the multiplication of bacteria may be stimulated by its use. Whenever anything in this way is given it should be soured. We know that in connection with fattening poultry these two products are found to be highly beneficial. At one time they were not thought desirable for young chickens. As a first feed, when the chickens are 48 to 60 hours old, these may be given some butter milk to drink, which will have the effect of clearing the intestine of minute but none the less dangerous enemies. A further point is that both skim milk and butter milk have a considerable feeding value, and therefore two purposes are served. Milk must not be allowed to stand in the sun, but be given in small quantities at stated intervals. Upon many farms, where butter-making forms part of the operations, there is an abundance of butter milk, and on cheese farms whey, which has a similar influence.

If water is supplied in vessels, these must be renewed frequently and be kept scrupulously clean.

CHARCOAL

Under our present system of management, and especially where the food given to fowls is not such as they would obtain for themselves when at liberty, there is a considerable danger of digestive trouble arising, from the fact that, in the first place, the birds do not obtain the right class of food, and, in the second, they frequently fail to exercise the body sufficiently to enable effective digestion to take place. The remedy is, of course, to alter this condition of affairs. That is not always easy. A most valuable corrective is vegetable charcoal, which has a beneficial influence upon the process of digestion. Fowls as well as other animals find in this material elements of which they appear to be deprived under the conditions named. The plan should be adopted of placing vegetable charcoal within reach of the birds and allowing them to help themselves. It is surprising what, under these conditions, fowls will consume. It is also suggested that use of finely powdered vegetable charcoal mixed with food given to the birds undergoing the process of fattening will help greatly in increasing the flesh upon the body. How far this arises from more perfect digestion of the food, or whether the carbon in the charcoal is turned into fat, has never yet been fully investigated. At any rate, we have sufficient evidence to know that the use of vegetable charcoal is desirable.

EARTH SALTS

That there is something deficient in our methods of feeding poultry under domestication has been apparent for a very long time. Many instances are to be found in which, both for old birds and young stock, there are evidences of malnutrition, which may arise from the giving of unsuitable foods—that is, such as are ill

balanced, or, by keeping the birds upon soil which is exhausted of natural elements, they are unable to find materials which are essential to digestion and, therefore, to health, but respecting which we know practically nothing. The influence referred to above is met with more especially where fowls are kept within confined or restricted areas and where there is a deficient supply of vegetable foods. We must not forget that many of the juices that are essential for complete digestion are obtained from food in its green form. That is regarded as true in the case of human beings, and must be so to a greater extent with animals and birds. There is a direction other than what we commonly regard as food where elements are supplied that can be obtained in no other way. Various attempts have been made to provide these earth salts artificially. Both in America and South Africa mixtures have been put upon the market for this purpose, and the claim is made that they have been highly beneficial. We have not, however, as yet any definite information of the result of exhaustive experiments. The point that can be urged is the use of green food to a much greater extent and to give the birds access to mineral and earthy substances as under natural conditions. Those who keep their fowls on open land need not trouble themselves much in the way indicated. The main thing is not to overfeed their birds, but to make them forage as much as possible. It is a totally different matter for those who are compelled to keep their fowls within restricted areas. Earth salts differ materially from grit, consisting of pieces of sharp stone, used in the gizzard for grinding the food. This should always be available.

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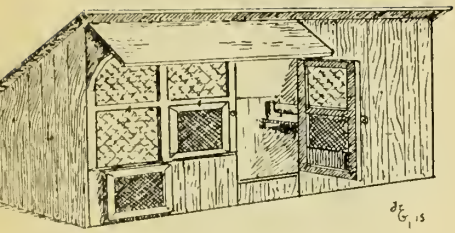

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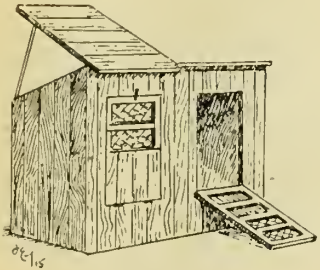

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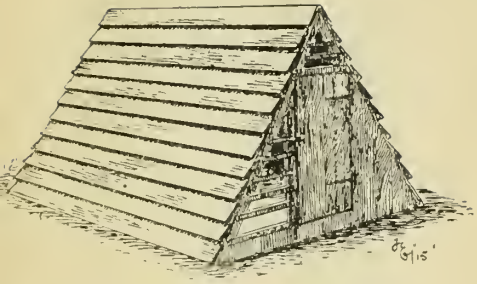

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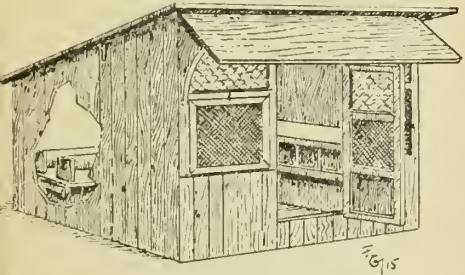

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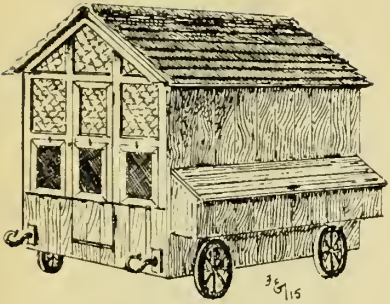

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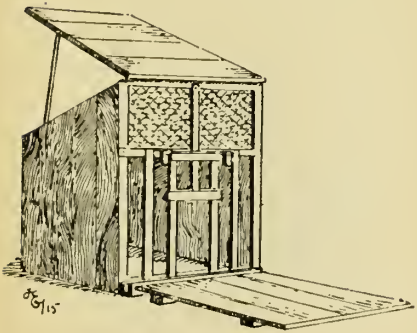

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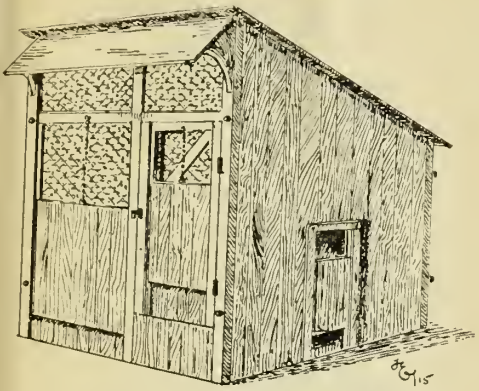

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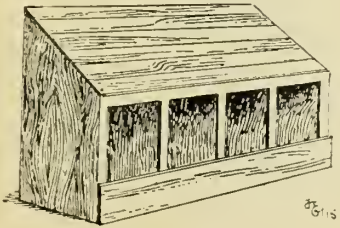

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